Climate project methodology № 0006

ENERGY EFFICIENCY TECHNOLOGIES AND FUEL SWITCHING IN NEW AND EXISTING BUILDINGS

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Contents

1. Terms and Definitions

For the purpose of this methodology, the following definitions apply[1]:

B-settings (Building settings)[2] refer to physical base properties of a building as below:

1) Building envelope (e.g. dimensions and building geometry, location of building surfaces such as windows, doors and skylights, orientation of external surfaces, building shades and shading from nearby objects, relative position of the building thermal zones);

2) Thermal properties (layer-by-layer description of the building materials with their conductivity, specific heat and density);

Building - a three-dimensional building system that has above-ground and (or) underground parts, including premises, engineering and technical support networks and systems and is intended for living and (or) activities of people, locating production, storage of products or keeping animals[3];

Buildings, constructions and premises for public purposes - buildings and constructions for facilities serving the country population, buildings for public facilities, as well as multifunctional buildings (premises), see Appendix 1[4];

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[1] When using the regulations and sets of rules referenced in this methodology, it is recommended to check the validity of reference documents in the public information system - on the official website of the federal executive body in the field of standardization on the Internet or according to the annual information index "National Standards".
[2] National standard of the Russian Federation GOST R 54862-2011 “Energy efficiency of buildings. Methods for determining the impact of automation, management and operation of a building” (approved by order of the Federal Agency for Technical Regulation and Metrology of 15.12.2011 № 1567-st)
[3] Federal Law of December 30.12.2009 № 384-FZ "Technical Regulations on the Safety of Buildings and constructions" article 2, paragraph 2, subparagraph 6 and 24
[4] See: Code of Rules SP 118.13330.2022 Public buildings and constructions SNiP 31-06-2009

Building Energy Management Systems (BEMS) – BEMS a building energy management system includes the collection, recording, alarming, reporting and analysis of energy consumption data, etc. The system is designed to reduce energy consumption, increase its usefulness, reliability and predict the performance of technical building systems, as well as optimize energy consumption and reduce their cost[5];

Chilled water[6] - water or water mixture that circulates through an evaporator unit, where it is cooled by a refrigerant as the latter evaporates. The chilled water in turn circulates to the applications that need to be cooled (e.g. space in buildings), where it exchanges heat, and is re-circulated back to the evaporation unit;

Cohort of existing buildings – buildings that have finalized the construction more than five years before the end of the data coverage period;

Cohort of new buildings – buildings that have finalized the construction within the five years before the end the data coverage period.

Construction - a three-dimensional, planar or linear building system, which has ground, above-ground and (or) underground parts, consisting of load-bearing, and in some cases, enclosing building constructions and designed to perform production processes of various types, store products, temporary stay of people, movement of people and goods;

Cooling Degree Days (Cooling period degrees-days, CDD) - A characteristic of the duration of energy use to achieve comfortable conditions during the cooling period[7]. The term is commonly used in calculations related to the energy consumption required to cool buildings;

Crediting period – the period in which verified and certified GHG emission reductions or increases in net anthropogenic GHG removals by sinks attributable to a climate project activity, as applicable, can result in the issuance of carbon units. The time period that applies to a crediting period for a climate project activity, and whether the crediting period is renewable or fixed, is determined in accordance with Section 4. Project crediting period of this methodology.

Data coverage period – the period for which activity data on the operation of the buildings (i.e. electricity consumed, fuel consumed and hot/chilled water consumed) is collected for the establishment or update of the baseline (applicable to the conservative baseline estimation approach).

Data currentness – the time gap between the end of the data coverage period and the complete submission of the baseline (applicable to the conservative baseline estimation approach).

Gross building floor area (GFA) - the area occupied by internal walls and partitions of the premises and calculated in accordance with the construction codes[8];

Heating and hot water supply systems - the heating and hot water systems include all the components necessary to supply thermal energy for heating and hot water. They consist of heat sources, heating devices, water treatment, water heaters, pipelines for transporting thermal

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[5] GOST R 54862-2011 “Energy efficiency of buildings. Methods for determining the impact of automation, management and operation of a building”

[6] It is important for project developer not to confuse chilled water and cold water from the cold water supply system. These emission sources are not accounted for this methodology.

[7] SP 370.1325800.2017 "Devices for sun protection of buildings. Design rules (with Amendments № 1). (Solar Shading Devices in Buildings. Design rules).

[8] SP 55.13330.2011 Code of rules Residential single-apartment houses. Updated edition of SNiP 31-02-2001; SP 54.13330.2016 Code of rules Residential multi-apartment buildings. Updated edition of SNiP 31-01-2003; Code of rules SP 118.13330.2022 Public buildings and constructions SNiP 31-06-2009

energy, hot water and devices for regulating and controlling the temperature of water and heating system[9];

Heating Degree days (Heating period degrees-days, HDD) - indicator[10] equal to the product of the difference between the indoor air temperature and the average outdoor air temperature for the heating period[11] by the duration of the heating period. The term is commonly used in calculations related to the consumption of energy required to heat buildings;

Hot water - water prepared by heating drinking or process water using thermal energy, and, if necessary, also by cleaning, chemical treatment and other technological operations carried out with water[12].

Multi-apartment residential building - a building consisting of two or more apartments, which includes common property, consisting of two or more apartments, including the property specified in paragraphs 1-3 of part 1 of article 36 of the Housing Code, see Appendix 1[13];

Municipality - urban or rural settlement, municipal district, municipal district, urban district, urban district with intracity division, intracity district or intracity territory of a city of federal significance[14];

Occupancy – the average number of residents/users of the building (premises) in a defined period of time (weekdays, weekends and holidays)[15];

Premises - part of a building or a construction, which has a specific purpose and is limited by building constructions and allocated to a specific user, which can be either a tenant or an owner. If a building (construction) has more than one tenant/owner[16], then the premises is defined as the part of the building leased to one tenant or used by the owner[17]. If the building is used by one tenant/owner, then for the purposes of this Methodology, the premises are equal to the entire building[18];

Residential premises - isolated premises, which is a real property and is suitable for permanent residence of people (meets the established sanitary and technical rules and regulations, other legal requirements)[19], see Appendix 1[20];

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[9] GOST 34059-2017. Interstate standard. Engineering networks of buildings and structures internal. Installation of heating, hot and cold water supply systems. General technical requirements; SP 60.13330.2020 Code of Practice for Heating, Ventilation and Air Conditioning

[10] SP 50.13330.2012 Code of Practice for Thermal Protection of Buildings. Revised edition of SNiP 23-02-2003 (as amended №1). It should be borne in mind that the methods of determining the HDD in Russia and other countries are not the same.

[11] SP 124.13330.2012 "Heat networks. Revised edition of SNiP 41-02-2003".

[12] Federal Law № 416-FZ of 07.12.2011 "On Water Supply and Sanitation", Art. 2.

[13] Housing Code of the Russian Federation dated December 29, 2004 No. 188-FZ. (with amendments and additions), Article 15

[14] Federal Law № 131-FZ of 06.10.2003 “On the General Principles of Organization of Local Self-Government in the Russian Federation” (as amended)

[15] Building occupancy conditions: (a) year-round use (applicable only to residential buildings of any storey); (b) average use of at least 30 hours per week (applicable only to buildings, structures, and public facilities of any storey)

[16] A tenant/owner can be either an individual, or a group of individuals sharing the same building unit.

[17] Residential building unit is an example. The term residential building unit refers to a single housing unit. Namely, a single family home is one residential building unit while a building with ten apartments has ten residential building units.

[18] Schools are a typical example. As a school is normally occupied by an owner (e.g. municipality), the entire school building, not each classroom, is considered as a building unit in this methodology.

[19] Housing Code of the Russian Federation dated December 29, 2004 No. 188-FZ. (with amendments and additions), article 16, part 1, paragraph 3

[20] See: SP 55.13330.2011 Code of rules Residential single-apartment houses. Updated version of SNiP 31-02-2001 and SP 54.13330.2016 Code of rules Residential multi-apartment buildings. Updated version of SNiP 31-01-2003 (Multicompartment residential buildings)

Single - family house (residential building) - a separate building, which consists of rooms, as well as auxiliary premises, designed to meet peoples' domestic and other needs related to living in such a building, see Appendix 1;

TDL (Network losses) - the average level of losses of electrical and thermal energy during transmission and distribution, as well as the loss of hot, drinking, technical water during production and transportation.

The boundary of an administrative-territorial and (or) municipal formation is a line that defines the boundaries of the territory of an administrative-territorial and (or) municipal formation[21].

T-settings (Building Performance) refers to the characteristics of the building related to ownership and tenancy, including the internal loads:

1. Occupancy or average number of people per time period (such as population counts in weekdays, weekends and holidays, assignments to thermal zones);

2. Lighting and equipment power density. Data collected may include fixture counts, fixture types, nameplate data from lamps, 24-hour weekday, weekend and holiday schedule of lighting use, characteristics of fixtures for estimating radiative and connective heat flows, thermal zone assignments and diversity of operations;

3. Internal load schedules and plug loads, including their counts, nameplate data, usage schedules and diversity of operations;

4. Building operations reflecting occupant behaviour:

    4.1. Control temperatures;

    4.2. Window opening;

    4.3. Other related schedules;

    4.4. Actual weather data;

    4.5. Energy consumption (by fuel type) in the first 12 months of building operation;

5. Building operation associated with the use of a district heating system (heating and hot water supply, if any):

5.1. Heat supply system (at building inputs)[22];

5.2. Heating system (in the building)[23];

5.3. Hot water supply system (in building)[24];

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[21] Federal Law № 131-FZ of 06.10.2003 “On the General Principles of Organization of Local Self-Government in the Russian Federation” (as amended)

[22] The heating system (at the building inlets) can be 2-pipe (supply and return); 3-pipe (heating supply and return, hot water supply) or 4-pipe (heating supply and return, hot water supply and return)

[23] Heating system (in the building) may be direct (i.e. without mixing devices), dependent (i.e. mixing through elevator unit or pump) or independent (i.e. through heat exchanger); presence of automatic weather control - yes / no; risers - one-pipe / two-pipe; flow - top / bottom; radiators in the apartments may be equipped with thermostats, valves or with no regulation

[24] Hot water supply system (in the building) may be open (i.e., taking mains water) or closed (i.e., heating of cold water in a heat exchanger: boiler house, central heat exchanger) or in the house itself; availability of temperature control automatics in the hot tap water system - yes / no; with or without circulation pipelines in the basement, risers and apartments; risers - insulated or not; with towel dryers in bathrooms or not

5.4. Temperature schedules specified in the heating contract or in the technical conditions (i.e. maximum temperature in supply and return pipes)[25];

5.5. Temperature schedule for hot water supply system[26];

5.6. Circulating pumps in the heating system[27];

5.7. Start and end dates of the heating season;

5.8. Interruptions in hot water supply.

Water Cooled Building Air Conditioning System (chilled water system) - includes all components needed to provide chilled water cooling services for buildings. It includes one or more chillers plus auxiliary equipment such as pumps to circulate chilled and condensing water, fans to circulate cooling air in the condenser, associated piping and fans used for cooling in the cooling tower;

2. Scope and applicability

The following table describes the key elements of the methodology:

Table 1. Methodology key elements

Typical projects	Project activities implementing energy efficiency- measures and/or fuel switching in new or existing buildings (premises) (see Appendix 1). Examples of the measures include efficient appliances, efficient thermal envelope, efficient lighting systems, efficient heating, ventilation and air conditioning (HVAC) systems, passive solar design, optimal shading, building energy management systems (BEMS), intelligent energy metering and switch to less carbon intensive fuel
Type of GHG emissions mitigation action	Energy efficiency. Electricity and/or heat and/or fuel savings through energy efficiency improvement. Use of less-carbon-intensive fuel

Given methodology is unaffected by applying to the greenhouse gases (GHG) programs[28]. If a GHG program[29] is applied, then the requirements of this program supplement the requirements of the methodology. This methodology is prepared based on the existing methodology developed under the Clean Development Mechanism (AM0091) and includes its adaptation to the current Russian regulations and standards.

[25] The temperature settings specified in the heating contract or in the technical conditions may be for the heating system (i.e. inlets to the building); for the heating system (i.e. outlets from individual heating substation)

[26] The temperature schedule for the hot water supply system can be, for instance, for the temperature in the flow pipe or the temperature at the outlet of the taps

[27] This parameter can include the number of circulation pumps in the heating system (pcs) and their total capacity (kW); DHW circulation pumps: number (pcs) and total capacity (kW); cold water booster pumps: number (pcs) and total capacity (kW); other energy equipment and its total capacity (kW)

[28] Greenhouse gas programme, GHG programme - voluntary or mandatory international, national or subnational system or scheme that registers, accounts or manages GHG emissions, GHG removals, GHG emission reductions or GHG removal enhancements outside the organization or GHG project (ISO 14064-2:2019 | Greenhouse gases, Part 2).

[29] Example of GHG programs in Russia - GOST R ISO 14064-1-2021 (accounting and management of GHG emissions at the level of organizations), GOST R ISO 14064-2-2021 (accounting and management of GHG emissions at the project level), GOST R ISO 14067-2021 (carbon footprint of products); at the international level – European Union Emission Trading System (EU ETS), Clean Development Mechanism (CDM), GHG Protocol for Corporate / Project / Products and for Scope 3 Accounting, Verified Carbon Standard (VCS), Gold Standard, etc.

The methodology includes large-scale projects[30] for energy efficiency in buildings (premises) and is developed in close cooperation with the methodology "Energy efficiency and fuel switching measures for buildings (small-scale)", which provides a basis for projects for energy efficiency in buildings (premises) in case of single or small-scale construction projects and offers simplified estimation algorithms[31].

2.1. Scope

The scope of this methodology includes project activities that implement energy efficiency measures and/or fuel switching in new or existing buildings.

2.2. Applicability

This methodology applies to project activities that implement energy efficiency measures and/or fuel switching in new or existing buildings (premises) (see Appendix 1). Examples of the measures include efficient appliances, efficient thermal envelope, efficient lighting systems, efficient heating, ventilation and air conditioning (HVAC) systems[32], passive solar design, optimal shading, building energy management systems (BEMS), intelligent energy metering, and fuel switching, excluding switching to biomass[33].

Project proponents should clearly describe in the Project design document (PDD) whether a proposed project activity involves the construction of new buildings, retrofitting existing one or the combination of both (construction new and retrofitting existing buildings) and which are the measures to be implemented under the project activity[34].

The methodology is applicable under the following conditions:

1) Buildings (premises) eligible for applying the methodology should belong to the types of buildings as defined in Appendix 1;

2) The sources of emissions eligible under the methodology are those including consumption of electricity, heat, fossil fuels, chilled/hot water (in chilled and hot water supply systems) as well as leakage of refrigerant used in the buildings (premises). Project developer needs to distinguish between chilled water[35] and cold water from the cold water supply system, this methodology considers emissions from the consumption of chilled water in the context of their use in building cooling systems[36];

3) None of the project buildings (premises), that are used for the calculation of project emissions receives electrical or thermal energy by biogas systems. This condition is to be verified both ex ante and ex post the implementation of the project.

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[30] Examples of projects are typical construction of new districts in large cities, renovation-type projects in Moscow, etc.

[31] Though the approaches are similar, some algorithms in the methods are different. It is important for the project developer to pay attention to this.

[32] HVAC (Heating, Ventilation and Air Conditioning) systems, see SP 60.1Z3Z0.2020 "SNiP 41012003 "Heating, ventilation and air conditioning" (approved and put into effect by Order of the Ministry of Construction of Russia dated December 30, 2020 N 921 / pr)

[33] The use of biogas/biomass could lead to methane emissions and leakage emissions, for example due to diversion of biomass from other uses to the project. These emission sources are not accounted for in the emission reductions calculation of the current version of this methodology. Thus, the use of biogas/biomass is excluded

[34] The project developer should check the activities planned for implementation as part of the climate project for consistency with the requirements for qualifying projects as climate projects under Order No. 248 of the Ministry of Economic Development of the Russian Federation of 11.05.2022, "On Approval of the Criteria and Procedure for Classifying Projects Implemented by Legal Entities, Individual Entrepreneurs or Individuals as Climate Projects and the Form and Procedure for Reporting on Implementation of a Climate Project".

[35] See **Chilled water** in Section 1.

[36] The use of chilled water (or coolant), as opposed to cold water, implies the use of refrigerants in special water cooling systems of buildings. That is why the concept of chilled water is related to accounting of refrigerants, as indicated below in Table 2 of Section 2.3. A special block of accounting refrigerants is related to the use of traditional methods of air conditioning in buildings.

4) None of the project buildings (premises), that are used for the calculation of project emissions receives electrical or thermal energy by biomass. This condition only concerns biomass-fired boilers, and excludes smaller appliances where only an insignificant amount of biomass is burned. This condition is to be verified both ex ante and ex post the implementation of the project.

5) It is allowed that the buildings (premises) of the project receive electrical or thermal energy from cogeneration systems. Distribution of fuel consumption for electrical and thermal energy produced in the cogeneration mode can be carried out according to physical, proportional, and other methods. The project developer can independently determine the method of distribution of fuel consumption[37]. It is necessary that the chosen method for allocating fuel consumption does not change during the crediting period. This condition is to be verified both ex ante and ex post the implementation of the project;

6) The location of buildings (premises) must be limited to one climatic zone with similar legislative requirements for the buildings (premises). The difference between HDD/CDD between municipalities in which the project buildings (premises)are located should not be more than +/- 20 %;

7) None of the project buildings (premises) used for the calculation of project emissions use chlorofluorocarbon (CFC) as a refrigerant. This condition is to be verified both ex ante and ex post the implementation of the project;

8) None of the project buildings (premises) used for the calculation of project emissions claim carbon units for emission reductions achieved by using efficient appliances being credited in other project activities registered as projects. This condition is to be verified both ex ante and ex post the implementation of the project. If there is no project receiving carbon units from the use of efficient appliances, this applicability condition is deemed satisfied. Otherwise, a discount factor shall be applied to the energy consumption of the project buildings (premises) in order to avoid possible double-counting[38] of emission reductions;

9) All the project buildings (premises) must comply with national legislation on energy efficiency (e.g. building codes and regulations, GOST standards, etc.) in the project boundary. This condition is to be verified both ex ante and ex post the implementation of the project;

10) The renewable energy technologies that emit a material amount of GHG emissions (e.g. geothermal power plants, reservoir-type hydro power plants) are not allowed as a captive power source to project buildings (premises). However, geothermal plants are allowed to provide steam for heating, chilled/hot water system(s);

11) Project developer shall demonstrate that the building energy simulations and related calibrations have been performed by skilled operator(s) as demonstrated by having at least

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[37] Project developer can use the following documents: RD 34.08.552-95 “Guidelines for compiling a report of a power plant and a joint-stock company for energy and electrification on the thermal efficiency of equipment” or “Methodological guidelines for the distribution of specific fuel consumption in the production of electric and thermal energy in the combined generation mode electric and thermal energy used for the purpose of tariff regulation in the field of heat supply”, approved by the Order of the Ministry of Energy of Russia dated 12.09.2016 No. 952

[38] Double counting: accounting for GHG emissions or removals more than once. Double counting can occur between organizations, i.e. two or more reporting organizations take ownership of the same GHG emissions or removals. Double counting can also occur inside an organization when GHG emissions or removals are taken into account in different categories (this type of double counting should not occur). (ISO/TR 14069:2013 Greenhouse gases - Quantification and reporting of greenhouse gas emissions for organizations - Guidance for the application of ISO 14064-1). See also GOST R ISO 14080-2021. National Standard of the Russian Federation. Greenhouse gas management and related activities. A system of approaches and methodological support for the implementation of climate projects

three years of relevant experience and professional education and/or training[39]. Standardized programs that meet the requirements of national legislation should be used for computer modeling[40].

The approaches proposed in this methodology are consistent with the standardized approach applied at the international level[41]. In case of changes in legal framework of the Russian Federation, this methodology is subject to revision in order to take into account the relevant changes[42].

2.3. Project boundary

The spatial extent of the project boundary encompasses the area covering all the project and baseline buildings (premises). In addition, the spatial extent of the energy supply systems that supply energy to the project and baseline buildings (premises) is included in the project boundary.

The spatial extent of an electricity system refers to the group of existing power plants which current electricity generation would be affected by the proposed project activity, and also to the group of prospective power plants which construction and future operation would be affected by the proposed project activity.

The spatial extent of a heating, chilled/hot water systems encompasses:

1) All thermal sources directly serving the heating, chilled/hot water systems. In the case of geothermal heat extraction, the site of the geothermal heat extraction including geothermal wells, re-injection wells, pumps, geothermal water storage tanks, etc.;

2) All equipment including heating systems, pipes, sub-stations, pumps, cooling towers, meters, transformers and control equipment used for the supply of the energy service through heat, chilled/hot water to users that are or will be connected to the heating, chilled/hot water systems;

3) The electricity system to which the heating, chilled/hot water system(s) is connected.

The greenhouse gases (GHGs) included in or excluded from the project boundary are shown in Table 2.

Table 2. Emission sources included in or excluded from the project boundary

Source		GHG	Included	Justifica
Baseline	Electricity consumption in buildings	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
	Fuel consumption in buildings	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source

[39] In the Russian Federation, energy modeling of buildings (Building energy modeling – BEM) is an integral part of computer modeling technologies and is included in the section "BIM Analysis" (information modeling of a capital construction object). Standards information modeling is included in a new list of documents for voluntary use (order of Rosstandart from 17 April 2019 No. 831) 2019, as the enforcement of the Federal law of December 30, 2009 No. 384-FZ "Technical regulations on safety of buildings and constructions", including the national standards and regulations on information modeling

[40] For computer modeling, programs such as ArchiCAD can be used, as well as additional integrating software complexes for solving problems of the stages of the building life cycle, such as PHPPP, MagiCAD, AnsysFluent, The Building Energy Simulation Test (BESTEST), eQUEST, EnergyPlus and other simulation software and tools (for example from the list https://www.eurosis.org/cms/?q=node/1318)

[41] Methodology AM0091: Energy efficiency technologies and fuel switching in new and existing buildings. Version 4.0.

[42] The project developer should keep in mind that the normative documents given in the text can be changed or canceled

Source		GHG	Included	Justifica
		N_2O	No	Minor emission source
	Heat, chilled/hot water consumption in buildings	CO_2	Yes	Main emission source
		CH_4	Yes	If a hot water system is supplied heat by a geothermal plant(s) /source(s), fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam shall be accounted for
		N_2O	No	Minor emission source
		Refrigerants that are GHGs	Yes	Major emission source
	Leakage of refrigerant(s) in buildings	Refrigerants that are GHGs	Yes	All GHGs[43] shall be considered. If it is justified that the project activity does not result in an increase of such emissions, the source may be excluded.
Project activity	Electricity consumption in buildings	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
	Fuel consumption in buildings	CO_2	Yes	Main emission source
		CH_4	Yes	Minor emission source
		N_2O	No	Minor emission source
	Heat, chilled/hot water consumption in buildings	CO_2	Yes	Main emission source
		CH_4	Yes	If a hot water system is supplied heat by a geothermal plant(s) /source(s), fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam shall be accounted for
		N_2O	No	Minor emission source
		Refrigerants that are GHGs	Yes	Major emission source
	Leakage of a refrigerant(s) in buildings	Refrigerants that are GHGs	Yes	All GHGs[44] shall be considered. If it is justified that the project activity does not result in an increase of such emissions, the source may be excluded

If the facilities within the project boundary as specified in this methodology are owned by different legal entities (or are under the operational management of different legal entities), then the project documentation should include a description of procedures for eliminating the possibility of double counting in GHG emission reductions potentially achieved as a result of project activities, enshrined in contractual agreements.

3. Baseline methodology

The baseline[45] is set conservatively[46] for a business-as-usual activity, taking into account all existing policies and measures, but not considering additional project activities (Business-as-usual model).

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[43] Include GHGs listed in Annex A of the Kyoto Protocol as well as GHGs controlled under the Montreal Protocol

[44] Same as baseline

[45] Greenhouse gas baseline, GHG baseline - quantitative reference(s) of GHGemissions and/or GHGremovals that would have occurred in the absence of a GHG project and provides the baseline scenario for comparison with project GHG emissions and/or GHG removals (ISO 14064-2:2019 Greenhouse gases - Part 2)

[46] Calculation of the baseline is considered conservative if the final estimate of emission reductions resulting from project activities will not be overestimated. If there is any doubt, the project developer should better understate the baseline projection.

The project developer may use one of the following approaches to determine the baseline with justification for the appropriateness of the choices[47]:

1) best available technologies[48] that represent an economically feasible and environmentally sound course of action;

2) an ambitious benchmark approach where the baseline is set at least at the average emission level of the 20% best performing comparable activities providing similar outputs and services in a defined scope in similar social, economic, environmental and technological circumstances;

3) an approach based on existing actual or historical emissions, adjusted downwards by at least 5%, unless otherwise specified in the project methodology.

The approaches above provide a framework for general understanding of the ways in which baselines can be defined. A detailed approach to determining the baseline for this type of project is provided in Sections 3.1-3.3 and Appendix 3.

The level of buildings' energy consumption should not exceed the current legislative requirements for the energy efficiency of buildings[49]. For buildings of different categories (both new buildings and/or for existing buildings), different specific consumption requirements are established, which are mandatory for all types of buildings, except for individual building. The standards are set and updated by the Ministry of Construction (Minstroy) of the Russian Federation, general requirements are regulated by national regulations[50].

Project developer has the right to use methodologies and CO_2 emissions factors legislatively approved within the territory of the Russian Federation[51]. In this case, the Project Developer must independently determine the most relevant approach and the level at which the methods will be applied, document and justify the applied algorithms for the validation and verification body.

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[47] Approaches to determining baselines are given in Action taken by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement at its third session (FCCC/PA/CMA/2021/10/Add.1, Article 6, paragraph 4, p. 34, para. 36). URL: https://unfccc.int/sites/default/files/resource/cma2021_10a01E.pdf.

[48] If there are reference documents of the best available technologies (BAT) applicable to the conditions of the planned project, the relevant information and technical BAT reference documents are used

[49] For example, for the buildings built after 2003 refer to SNiP 23-02-2003 "Thermal protection of buildings", published in 2003. It establishes the basic values of indicators of specific annual consumption of thermal energy for heating and ventilation of residential and public buildings and the minimum values of thermal protection of external enclosing constructions. These rules and regulations apply to the thermal protection of residential, public, industrial, agricultural and storage buildings and constructions in which it is necessary to maintain a certain temperature and humidity of the air.

[50] For example, Order of the Ministry of Construction and Housing and Communal Services of the Russian Federation dated 17.11.2017 № 1550/pr "On approval of energy efficiency requirements of buildings, constructions, structures", Order of the Ministry of Construction and Housing and Communal Services of the Russian Federation dated 06.06.2016 No. 399/pr "On approval of the Rules for determining the energy efficiency class of apartment buildings", Federal Law No. 384-FZ of 30.12.2009 (as amended on 02.07.2013) "Technical Regulations on the Safety of Buildings and Structures", Federal Law No. 261-FZ of 23.11.2009 (as amended on 14.07.2022) "On Energy Conservation and on Improving Energy Efficiency and on Amendments to Certain Legislative Acts of the Russian Federation" etc.

[51] See the Order of the Ministry of Natural Resources of the Russian Federation (27.05.2022 № 371) “On approval of methodologies for quantifying greenhouse gas emissions and removals of greenhouse gases”, Order of the Ministry of Natural Resources of the Russian Federation (16.04.2015 № 15-r) "On approval of guidelines for conducting a voluntary inventory of greenhouse gas emissions in the constituent entities of the Russian Federation", the IPCC Guidelines (2006), the Order of the Ministry of Natural Resources and Ecology of the Russian Federation (29.06.2017 № 330) "On approval of guidelines for quantifying the volume of indirect energy emissions of greenhouse gases"

3.1. Construction of new buildings

For new construction, two options are available to identify the baseline scenario[52] depending on the chosen approaches to estimate baseline, project emissions and emission reductions.

Option 1. Under this option a benchmark approach is applied to establish the baseline scenario using *Option 1* or *Option 2.1* in section 3.3 are used to estimate baseline and project emissions. The calculation of the benchmark is outlined in the section 3.3 and Appendix 3 below. The baseline scenario for new construction is buildings (premises) constructed and then occupied in the last five years in circumstances similar to the buildings (premises) constructed and then occupied in the project activity, differentiated by buildings (premises) category.

Option 2. This approach to identify the baseline scenario is applied when Option 2.2 in section 3.3 for estimating baseline and project emissions is used. Option 2 shall be used to identify baseline scenario, if modelling based on surveys is used for estimating emission reductions.

The alternatives for the assessment of the baseline scenario shall, at least, include the proposed project activity implemented without project and an alternative design of the project building that would have been built considering the building characteristics obtained from surveys of construction companies or experts as described in Option 2.2 in section 3.3 below.

3.2. Retrofitting existing buildings

For retrofitting existing buildings, relevant existing pre-retrofit building characteristics are assumed to be the baseline scenario.

For retrofits, the baseline emissions can be estimated via modelling (following *Option 2* below, where the building characteristics of the building before retrofit shall be used as inputs in the model and its historical energy consumption shall be used for the calibration of the baseline model) or Conservative approach to baseline estimation (following *Option 3* below).

The approach to estimate baseline emissions of existing buildings prior to their retrofit is described in the Appendix 3.

3.3. Baseline emissions

For this project activity, baseline emissions can be estimated:

Option 1. Calculation of baseline emissions based on the monitoring during the crediting period of a control group based on the top 20 % benchmark of best performing buildings. Steps to calculate baseline emissions are described in Figure 1;

Option 2. Modelling baseline emissions. Input data in the model can come from the following sources:

> *Option 2.1.* Building characteristics of the top 20 % benchmark of best performing buildings. To obtain these data, Step 1 to Step 4 described in Figure 1 shall be followed to identify the top 20 % best performing buildings and their baseline energy consumption and characteristics that should be used for the calibration of the baseline model;
>
> *Option 2.2*. Buildings characteristics are obtained from interviews with five construction companies or experts;

Option 3. Calculation of the baseline emissions based on conservative approach to baseline estimation (see Appendix 2). Project activities applying this option do not need to follow Step 1-Step 4 are described in Figure 1.

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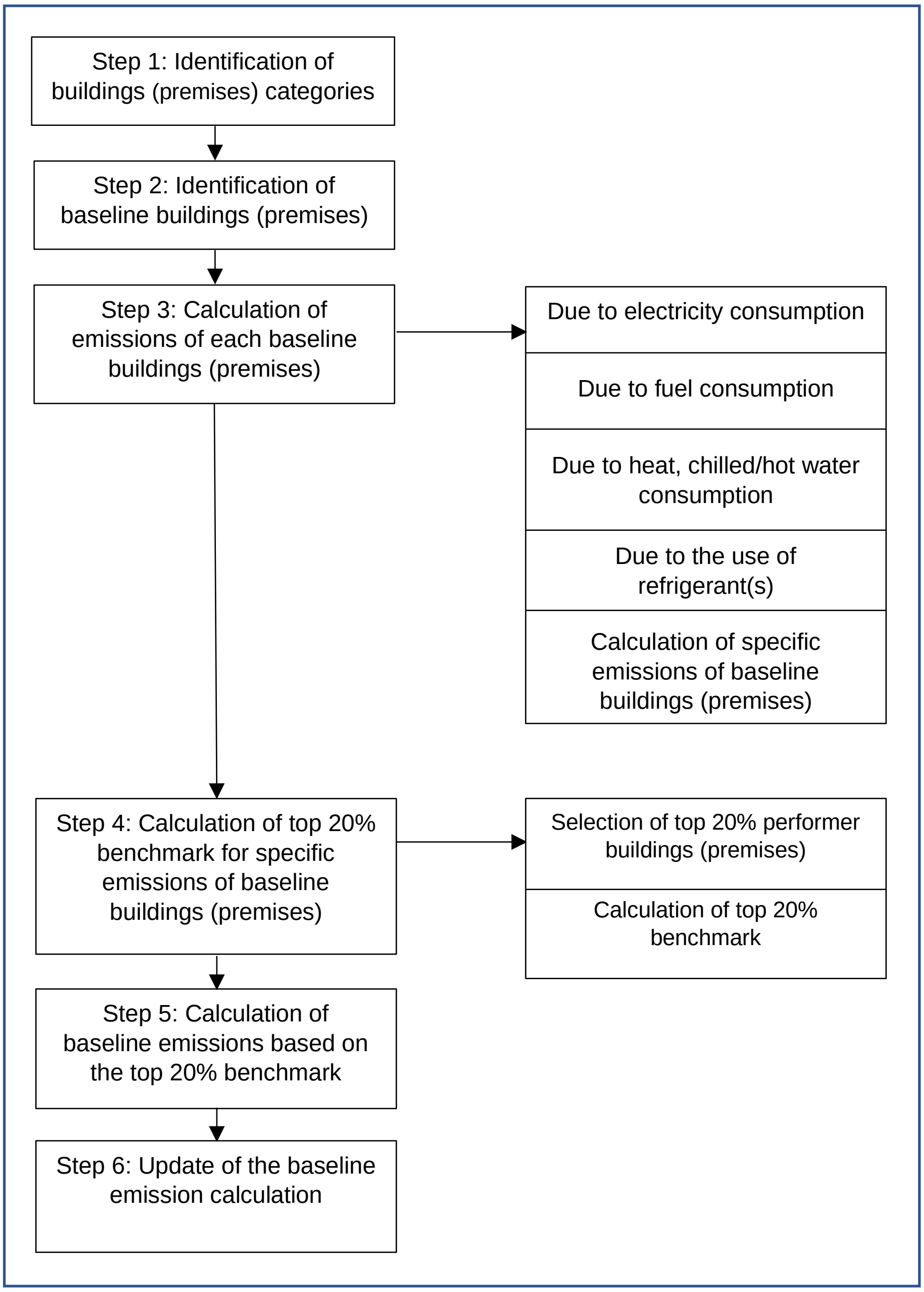
[52] Baseline scenario - hypothetical reference case that best represents the conditions most likely to occur in the absence of a proposed GHG project (ISO 14064-2:2019 Greenhouse gases - Part 2)

Figure 1. Flow chart of estimating baseline emissions using the top 20 % performance benchmark



Steps and algorithms to calculate baseline emissions are defined in Appendix 3.

4. Project crediting period

The starting date of project activities is not regulated.

A crediting period for emission reduction projects is a maximum of 5 years renewable a maximum of twice, or a maximum of 10 years with no option of renewal.

The crediting period begins no earlier than 5 years prior to applying for validation for projects validated until December 31, 2025, and no earlier than 2 years prior to applying for validation for projects validated after January 1, 2026.

The additionality and baseline shall be evaluated at the beginning of the crediting period and confirmed or reevaluated at the beginning of the next 5-year phase if the project is conducted 3 times 5 years each.

5. Additionality

Additionality shall be demonstrated using Guidelines №001 Demonstration of the additionality of the project activity[53], taking into account the specifics outlined in this section.

5.1. Construction of new buildings

For new construction, there are two possible options to demonstrate additionality, similar to the baseline scenario chosen by the project developer (a benchmark approach under *Option 1* or *Option 2.1* in section 3.3, or modelling based on surveys - *Option 2.2* in section 3.3, has been used).

Additionality of the project activity dealing with new construction is demonstrated for fuel switching measures employed in the project activity, if less carbon-intensive fuels used in the project buildings (premises) were not commercially available within the project boundary in the last five years.

If the less carbon-intensive fuels were commercially available in the project boundary in the last five years, separate additionality demonstration of the fuel switching measures is not required because it is assumed that the top 20 % benchmark will capture the autonomous fuel switching effect in the baseline. Based on the above, the following procedures shall be followed for the demonstration of additionality for fuel switching:

> *Step 1.* Identify the less carbon-intensive fuel used in the project buildings (premises) and check commercial availability of the fuel within the project boundary in the last five years. If the fuel has been commercially available in the last five years, it is not required to demonstrate additionality of the fuel switching measures. Otherwise, proceed to Step 2;
>
> *Step 2.* Additionality of the fuel switching measures shall be demonstrated comparing the historical average retail price of the fuel used in the project buildings (premises) since the fuel became commercially available within the project boundary, with the fuel that was the most commonly used within the baseline buildings (premises) for the same period. Retail prices per unit of energy[54] shall be used for the comparison. If the average retail price of the project fuel is higher than the one of the baseline fuel, the fuel switching measures are considered additional.

If the fuel switching measures are demonstrated to be additional or separate additionality demonstration of the fuel switching measures is not required[55], the project is deemed additional as long as the total emissions level from the buildings (premises) constructed in the project activity is lower than the baseline emissions level calculated by the benchmark analysis during each year of the crediting period.

If the fuel switching measures are not demonstrated additional or the project activity does not claim carbon units for emission reductions from the fuel switching measures, emission reductions from the fuel switching measures cannot be claimed for carbon units. In such a case,

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[53] The climate project implemented in the Russian Federation shall comply with Article 9 of the Federal Law (02.07.2021 №296-FZ) “On Limiting Greenhouse Gas Emissions”, as well as the criteria established in accordance with the Order of the Ministry of Economic Development of Russia (11.05.2022 № 248) "On approval of the criteria and procedure for classifying projects implemented by legal entities, individual entrepreneurs or individuals as climate projects, the form and procedure for submitting a report on the implementation of a climate project". Guidelines №001 has a framework character, giving a general understanding for ways and approaches to demonstrate the additionality of project activities. Methodology (sections 5.1 and 5.2) gives a more specific approach to the Guidelines statements in relation to this type of project activity.

[54] e.g. levelized cost of electricity production in RUB/kWh or levelized cost of delivered heat in RUB/GJ

[55] Either because the less carbon-intensive fuel used in the project building units was commercially available in the project boundary in the last five years, or there is no fuel switching measure involved in the project activity

the project emission calculation requires the carbon intensity of fuel energy[56] used in the project buildings (premises) to be the same as the one in the baseline. With this adjustment, however, emission reductions from energy efficiency measures can still be deemed additional as long as the total emissions level from the buildings (premises) constructed in the project activity is lower than the baseline emissions level calculated by the benchmark analysis.

The additionality demonstration also requires an analysis related to the implementation of planned measures to improve the energy efficiency of buildings (premises) in purpose of saving electrical and/or thermal energy (introduction of energy-saving technologies, processes, equipment, modernization of cooling and/or heating systems, etc., if applicable to the project activity). The steps to demonstrate additionality are performed in accordance with Guidelines №001 "Demonstration of additionality of project activities".

5.2. Retrofitting existing buildings

Additionality of the project activity associated with the retrofitting existing buildings, the corresponding characteristics of existing buildings before retrofitting are taken as a baseline scenario and *Option 2* from section 3.3 is used (see section 3.2 above).

Additionality of the project activity associated with the retrofitting existing buildings should be demonstrated using Guidelines №001 "Demonstration of the additionality of the project activity" are used.

Investment analysis: Option II Investment comparison analysis is applied. The analysis shall be conducted for the entire set of measures (not for an individual measure) planned to be implemented in a specific building type in the course of the project activity. When investment analysis is conducted for measures aimed at replacing existing equipment with new equipment or retrofitting existing equipment, the remaining lifetime of the baseline equipment shall be determined Project developer. Developer transparently in the PDD how the remaining lifetime of applicable equipment has been determined, including references to all documentation used.

For measures targeted at retrofitting individual building envelop components the service life can be established in the regulatory documents for the operation, reconstruction and repair of buildings. A period of 30 years is allowed for windows, doors and insulation materials[57].

Demonstration of additionality (see Guidelines №001) shall be conducted for each individual measure in the set of measures planned to be implemented in each buildings (premises) category according to the common practice analysis criterion. If, as the outcome of the common practice analysis, a particular measure is regarded to be common practice, then the characteristics of this measure need to be included in the baseline model.

6. Monitoring plan requirements

100% of the data should be monitored if not indicated otherwise in the table in Appendix 5. Some parameters either need to be monitored continuously during the crediting period or need to be calculated only once for the crediting period, depending on the data.

All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

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[56] Carbon intensity is the ratio of the amount of CO_2 emissions to the amount of energy consumed per year. Carbon intensity of fuel combustion in energy units.

[57] For example, SP 255.1325800.2016 Buildings and constructions. Operating rules. Basic provisions, Order of the State Committee for Architecture dated November 23, 1988 No. 312 “On approval of departmental building standards of the State Committee for Architecture “Regulations on the organization and conduct of reconstruction, repair and maintenance of residential buildings, communal and socio-cultural facilities”, etc.

All data collected as part of monitoring should be archived electronically and be kept at least for two years after the end of the last crediting period.

The calculation of the parameters, emission factors, sources of electricity consumption should be documented electronically that should be attached to the PDD. The documentation should include all data used to calculate the emission factors and other parameters. The data should be presented in a manner that enables reproducing of the calculation.

Information on updating emission calculations and monitoring parameters for the baseline and project scenario during the crediting period is described in Annexes 3 and 6. The data and parameters monitored as a result of the project activity are given in Appendix 5.

Changes required for methodology implementation in 2nd and 3rd crediting periods. For the parameters monitored ex post, there are parameters that require monitoring annually and at least every three years. For the latter parameters, the monitoring frequency does not necessarily coincide with the first year of the 2^{nd} and the 3^{rd} crediting periods. Therefore, updating of these parameters is not necessary at the renewal of the crediting period.

7. Project scenario

Depending on whether project emissions are estimated for new construction or retrofitting existing buildings, the following approaches are available.

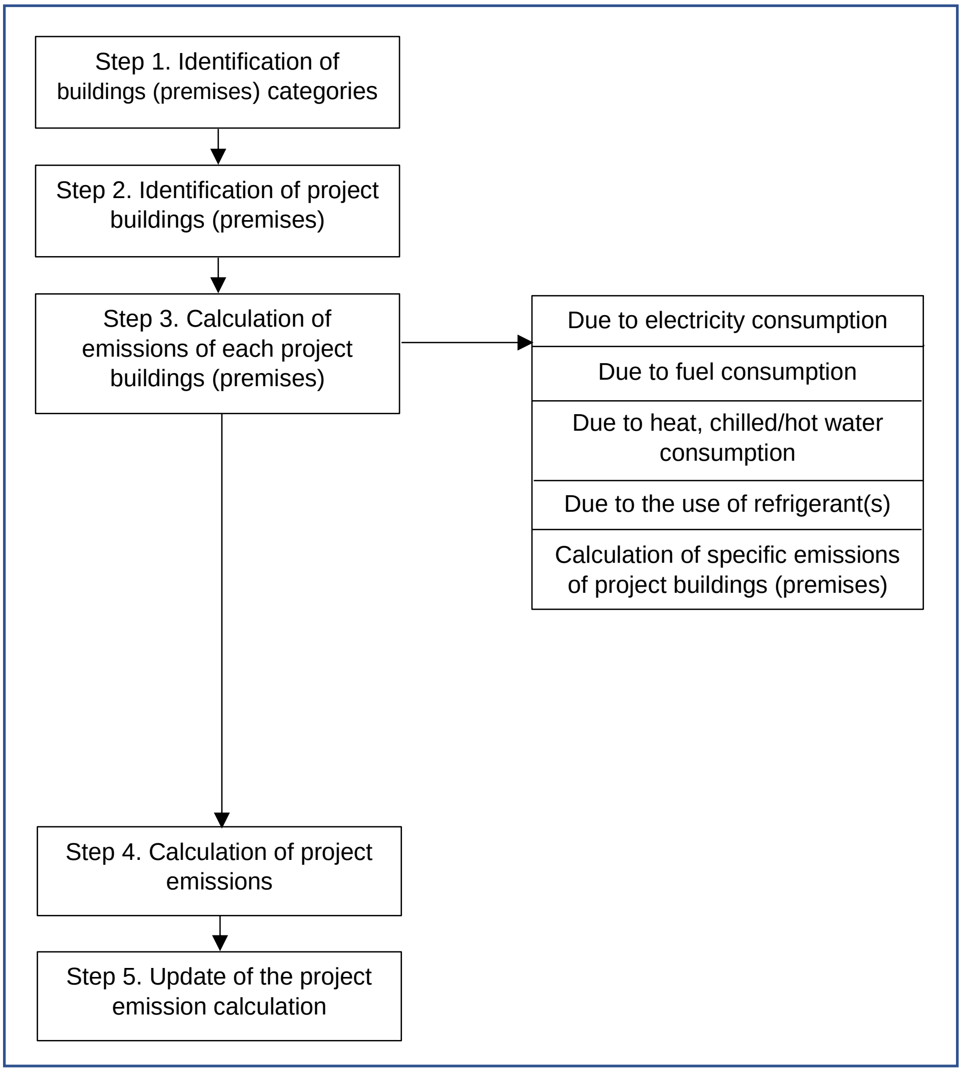
For new construction, project emissions can be estimated:

Option 1. Calculation of project emissions based on monitoring of energy consumption. Steps to calculate project emissions are described in Figure 2;

Option 2. Modelling project emissions.

For retrofits, the only option available is modelling.

Figure 2. Flow chart of estimating project emissions



Steps and algorithms to calculate project emissions are defined in Appendix 6.

Emission reductions

Two options to calculate emissions reductions are available depending on whether suppressed demand for energy services[58] existed to project implementation.

Option 1. Emissions reductions calculations without considering suppressed demand scenario.

Option 2. Emissions reductions calculations under suppressed demand scenario.

Suppressed demand for energy services is deemed to exist prior to project implementation if one or both conditions are observed:

- the project activity is implemented in rural areas of the country with the electrification rate being below 20 %[59];

- animal dung is the most common fuel used in the project area.

[58] Suppressed demand is the situation where energy services provided are insufficient (due to poverty or lack of access to modern energy infrastructure) to meet the needs of stakeholder taking into account its development needs. A minimum living standard of adequate space heating, indoor air temperatures, and adequate access to energy (including electricity) to meet basic human needs is taken into account

[59] The most recent available data on the electrification rates shall be used to demonstrate compliance with the 20 % threshold. In no case shall data be used if older than three years than the date of commencement of validation of the project activity

If a suppressed demand scenario is determined to exist, two options to address it in emissions reductions calculations are available.

Option 2a. This option is applicable if emissions reductions are estimated based on the top 20 % benchmark of best performing buildings.

Option 2b. This option is applicable if emissions reductions are estimated using a whole building computer simulation model.

Steps and algorithms to calculate project emissions and emission reductions for new construction / retrofitting existing buildings are defined in Appendix 6.

Risk management

As part of the project implementation, it is recommended to develop a risk assessment system with a description of the most likely risks that may arise at all stages of the climate project. For such an assessment, the project developer should develop a detailed matrix with the following information, as a minimum:

1. the main stages of the implementation of the climate project;

2. description of the risks that may arise at each stage of the climate project;

3. description of the probability of occurrence of risks (for this, the rating options "low, medium, high" or any other understandable numerical scales can be used);

4. description of the impact of each risk on the results of the entire project (for this, the rating options "low, medium, high" or any other understandable numerical scales can be used);

5. description of the period of influence of each risk on the entire climate project;

6. description of the developed measures to minimize or avoid each type of risks;

7. description of the time period required for the implementation of each measure that reduces or prevents the occurrence of risks is indicated.

The recommended table for completion, reflecting the result of the risk management measures is given in Appendix 7.

8. Leakage assessment

According to the Order of the Ministry of Economic Development of Russia dated May 11, 2022 N 248 project activities should not lead to an aggregate increase in greenhouse gas emissions or reduce their absorption levels outside the scope of such activities[60]. At the same time it is necessary to consider and fully account for if project leaks[61] exist in accordance.

If the project activity involves the replacement of equipment, it is necessary to justify and document the absence of leakage due to the possible reuse of the replaced equipment in another activity. The scrapping of replaced equipment must be documented.

In case the project activity involves fossil fuel switching measures, leakage resulting from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary shall be considered.

[60] Appendix № 1 to the order of the Ministry of Economic Development of Russia of May 11, 2022 № 248, paragraph "в"

[61] Leakage for a project activity - the net change of anthropogenic emissions by sources of GHGs which occurs outside the project boundary, and which is measurable and attributable to the climate project activity, as applicable (CDM-EB07-A04-GLOS Glossary CDM terms. Version 11.0)

Project developer must independently determine the most relevant methods will be applied to estimate leakage, document and justify the applied algorithms for the validation and verification body, including the approaches applied at the international level.

Equations for calculation leakage emissions are defined in Appendix 8.

9. Non-permanence risk analysis

Not applicable to the project activity.

10. Methods to prevent double counting, negative impacts on the environment and society

Climate project should demonstrate its compliance with all legal requirements in the jurisdiction where it is located (including but not limited to the Reference list methodologies). Project developer should question whether there is a risk that their project might result in negative impacts for local communities, biodiversity and the environment. Such projects should not cause an increase in atmosphere, soil, surface and ground water pollution as well as lead to any community conflicts, land tenure issues, forceful evictions, human rights violations, or worsened health and wellbeing due to restricted access to a forest or nature area.

Efforts should be made to avoid double counting[62] between project areas (project boundaries), between company reporting and reporting on the project, between the reporting of different companies, between the subjects of the Russian Federation and different countries in the case of international transfer of carbon units. In the latter case, it is necessary to demonstrate that the carbon units transferred at the international level are excluded from the accounting of the quantitative goals of the defined at the national level contribution of the Russian Federation.

11. Update of the baseline at the renewal of the crediting period

At the renewal of crediting period the project is subject to verification with elements of validation and a technical assessment by a validation and verification body to determine necessary updates to the baseline, the additionality and the quantification of emission reductions.

The renewal of the crediting period of a registered project activity shall only be granted if The Project developer can provide evidence that the original project baseline is still valid or has been updated taking account of new data where applicable.

Project developer shall update those sections of the project design document relating to the baseline, estimated emission reductions and the monitoring plan using an approved baseline and monitoring methodology: the latest approved version of a baseline and monitoring methodology, applied in the original PDD of the registered project activity, shall be used whenever applicable.

The demonstration of the validity of the original baseline or its update does not require a reassessment of the baseline scenario, but rather an assessment of the emissions which would have resulted from that scenario. The additionality at the renewal of the crediting period is checked for compliance to the criteria under Guidelines №001 at the date of the beginning of the new crediting period.

If a review or update of the baseline of a registered project has been made, the Project developer must justify the validation and verification body of the need to deviate from the approved methodology in order to extend the credit period.

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[62] The definition is given in the notes in section 2.2

Assessment the validity of the original/current baseline and to update the baseline at the renewal of a crediting period. A stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period consists of two steps. The first step provides an approach to evaluate whether the current baseline is still valid for the next crediting period. The second step provides an approach to update the baseline in case that the current baseline is not valid anymore for the next crediting period (see Appendix 4).

12. Normative references

1. AM0091: Energy efficiency technologies and fuel switching in new and existing buildings. Version 4.0. CDM Methodology
2. Order of the Ministry of Economic Development of Russia dated May 11, 2022 № 248 "On approval of the criteria and procedure for classifying projects implemented by legal entities, individual entrepreneurs or individuals, as climate projects, the form and procedure for reporting on the implementation of a climate project" (Registered with the Ministry of Justice of Russia on May 30, 2022 № 68642)
3. GOST R ISO 14064-1-2021. National Standard of the Russian Federation. Greenhouse gases. Part 1. Requirements and Guidance for Quantification and Reporting of Greenhouse Gas Emissions and Absorption at the Organization Level (approved and enacted by Rosstandart Order No. 1029-st dated 30.09.2021);
4. GOST R ISO 14064-2-2021. National Standard of the Russian Federation. Greenhouse gases. Part 2. Requirements and Guidelines for Quantification, Monitoring and Reporting Documents for Projects to Reduce Greenhouse Gas Emissions or Increase Their Absorption at the Project Level (approved and enacted by Order No. 1030-st of Rosstandart dated September 30, 2021);
5. GOST R ISO 14064-3-2021. National Standard of the Russian Federation. Greenhouse gases. Part 3. Requirements and Guidance for Validation and Verification of Greenhouse Gas Statements (approved and enacted by Rosstandart Order No. 1031-st of 30.09.2021);
6. GOST R ISO 14065-2014 National Standard of the Russian Federation. Greenhouse gases. Requirements for greenhouse gas validation and verification bodies for their application in accreditation or other forms of recognition (approved and enacted by Order of Rosstandart of 26.11.2014 № 1869-st);
7. GOST R ISO 14080-2021. National Standard of the Russian Federation. Greenhouse Gas Management and Related Activities. System of approaches and methodological support for the implementation of climate projects (approved and enacted by Order of Rosstandart No. 1033-st dated 30.09.2021);
8. GOST R ISO 14066-2013. National Standard of the Russian Federation. Greenhouse gases. Requirements for competence of greenhouse gas validation and verification groups (approved and enacted by Order of Rosstandart of 17.12.2013 № 2274-st);
9. Order of the Ministry of Natural Resources of Russia dated May 27, 2022 № 371 "On approval of methods for quantitative determination of greenhouse gas emissions and greenhouse gas removals" (from March 1, 2023, except for certain provisions, coming into force on March 1, 2024);
10. IPCC 2006. Guidelines for National Greenhouse Gas Inventories of the Intergovernmental Panel on Climate Change, 2006 / Edited by S. Iggleston, L. Buendia, K. Miwa, T. Ngara and K. Tanabe. // T.1-5. - IGES// Hayyam. 2006.
11. Order of the Ministry of Natural Resources of the Russian Federation (16.04.2015 № 15-r) "On approval of guidelines for conducting a voluntary inventory of greenhouse gas emissions in the constituent entities of the Russian Federation"
12. ISO 6707-1:2020 Buildings and civil engineering works — Vocabulary — Part 1: General terms. IDT. Publication date: 2020-08;

13. GOST R ISO 6707-1-2020. National Standard of the Russian Federation. Buildings and constructions. General terms (approved and put into effect by Rosstandart Order No. 1388-st dated 12/24/2020)
14. TOOL01 Methodological tool. Tool for the demonstration and assessment of additionality. Version 07.0.0. CDM Methodology
15. TOOL03 Methodological tool. Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion. Version 03.0. CDM Methodology
16. TOOL05 Methodological tool. Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation. Version 03.0. CDM Methodology
17. TOOL07 Methodological tool. Tool to calculate the emission factor for an electricity system. Version 07.0. CDM Methodology
18. Methodological Tool. Tool to determine the remaining lifetime of equipment. Version 01. CDM Methodology
19. Methodological Tool. Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period. Version 03.0.1. CDM Methodology
20. TOOL15 Methodological tool. Upstream leakage emissions associated with fossil fuel use. Version 02.0. CDM Methodology
21. TOOL31 Methodological tool. Determination of standardized baselines for energy efficiency measures in residential, commercial and institutional buildings. Version 01.1. CDM Methodology
22. Rosstandart Order No. 831 dated 17.04.2019 "On Approval of the List of documents in the field of standardization, as a Result of which Compliance with the Requirements of Federal Law No. 384-FZ dated December 30, 2009 "Technical Regulations on the Safety of Buildings and constructions" is ensured on a Voluntary Basis
23. Federal Law No. 384-FZ of December 30, 2009 "Technical Regulations on the safety of Buildings and constructions" (with amendments and additions)
24. Order of the Ministry of Construction and Housing and Communal Services of the Russian Federation dated 17.11.2017 No. 1550/pr "On approval of Energy efficiency Requirements of buildings, constructions, structures"
25. Federal Law No. 261-FZ of 11.23.2009 "On Energy Conservation and Energy Efficiency Improvement and on Amendments to Certain Legislative Acts of the Russian Federation"
26. GOST R 54862-2011 “Energy efficiency of buildings. Methods for determining the impact of automation, management and operation of a building” (approved by order of the Federal Agency for Technical Regulation and Metrology of December 15, 2011 No. 1567-st)
27. Housing Code of the Russian Federation dated 29.12.2004 № 188-FZ. (with changes and additions)
28. Code of rules SP 55.13330.2011 Code of rules Residential single-family houses. Updated edition of SNiP 31-02-2001
29. Code of rules SP 54.13330.2016 Code of rules Residential multi-apartment buildings. Updated edition of SNiP 31-01-2003
30. Code of rules SP 118.13330.2022 Public buildings and constructions SNiP 31-06-2009

Appendix 1. List of buildings (premises) categories

This list provides categories of buildings (premises) eligible under this methodology. The list categorizes buildings (premises) based on two criteria: (i) type of a building (premises); and (ii) height of a whole building that the buildings (premises) belongs to.

Definitions of buildings (premises) types eligible under this methodology are provided below.

A. **Buildings and premises for permanent residence of citizens:**

1. **Single - family house** (Detached single-family house) - residential buildings (hereinafter referred to as houses) with no more than three floors, intended for one family (objects of individual housing construction).

2. **Row houses - blocked residential buildings**, with the number of floors not more than three, consisting of several blocks, the number of which does not exceed ten and each of which is intended for use by one family, has a common wall (common walls) without openings with the neighboring block or neighboring blocks, is located on a separate land plot and has access to a common plot area (residential buildings of blocked development).

3. **Multi-apartment residential buildings** of any number of floors, including apartment-type dormitories, as well as residential premises that are part of the premises of buildings of other functional purposes (including an apartment building, an apartment building of a gallery type, corridor type and sectional type).

B. **Buildings and constructions** of any number of floors for **facilities serving the population:**

1. **Buildings and premises of educational organizations**: organizations of general and vocational education (preschool, general education, vocational education; educational organizations of higher education), educational organizations of additional education and organizations of specialized vocational education (aero clubs, driving schools, defense educational institutions, etc.), other organizations providing training under general education programs (sports schools, boarding schools, educational camps for children).

2. **Buildings and premises of healthcare and social services for the population**:

2.1. **Medical organizations**: hospitals, outpatient organizations, pharmacies, medical rehabilitation organizations, including those for children, blood transfusion stations, ambulance stations, etc., resort organizations.

2.2. **Social service organizations for the population**: with a hospital, semi-stationary and without a hospital (including boarding houses for the disabled and the elderly, for disabled children, rehabilitation centers, social adaptation centers, etc.).

3. **Buildings and premises** for enterprises and public **service organizations**:

3.1. **Retail and small wholesale enterprises**, as well as shopping and entertainment complexes.

3.2. **Catering establishments.**

3.3. **Objects of communal services to the population**.

3.3.1. **Public service enterprises** (repair and sewing workshops; laundries, dry cleaners, organizations providing rental services)

3.3.2. **Public utilities organizations** designed to directly serve the population (housing management companies, etc.).

3.3.3. **Sanitary service organizations** (baths, hairdressers, public toilets).

3.3.4. **Organizations of civil rights.**

3.4. **Communication facilities** intended for direct public service (post offices).

3.5. **Transport organizations** designed to directly serve the population:

3.5.1. **Station buildings** of all types of transport (air terminals, sea, river, railway stations).

3.5.2. **Transport hubs.**

3.5.3. **Agencies and offices** (tourist, real estate, ticket offices, insurance, etc.).

4. **Constructions, buildings and premises for cultural and leisure activities** of the population and religious rites.

4.1. **Sports facilities** and premises for sports and recreation, leisure purposes:

4.1.1. **Open flat constructions** (sports facilities, football stadiums)

4.1.2. **Indoor sports facilities** (arenas, swimming pools, sport clubs, aquaparks etc.)

4.2 **Buildings and premises for cultural and educational purposes** and religious organizations:

4.2.1**. Libraries, reading rooms, media libraries, archives**

4.2.2. **Museums, exhibitions, aquariums**, etc.

4.2.3. **Religious organizations** for the population

4.3. **Entertainment and entertainment organizations**

4.3.1. **Entertainment organizations** (theaters, cinemas, concert halls, circuses, etc.)

4.3..2 **Club and leisure and entertainment organizations**

5. **Buildings and premises for temporary residence**

5.1. **Hotels**, including motels, hostels, etc.

5.2. **Recreation and tourism organizations**:

5.2.1. **Boarding houses, tourist bases, year-round and summer camps**, including for children and youth, etc.

5.2.2. **Organizations for temporary residence** in non-stationary facilities

5.3. **Dormitories and dormitories of educational organizations** and social service organizations

6. **Facilities for pets and animals without owners** (treatment, maintenance and services for animals)

C. **Buildings (facilities)** of any number of floors of for the **service of public society and the state**

1. **Buildings of government bodies**, public service buildings

1.1. Buildings of state organizations for public service (multifunctional centers, territorial bodies of the Social Fund of Russia, social service bodies, labor exchanges)

1.2. **Management bodies** of firms, organizations, enterprises, as well as divisions of firms, agencies, etc.

2. **Specialized buildings**: credit organizations, courts and prosecutor's office, notarial and legal organizations, law enforcement organizations (tax services, police, customs, correctional institutions, isolation wards, etc.)

D. **Multifunctional public buildings (premises)** of any number of floors

Appendix 2. Conservative approach to baseline estimation

This appendix[63] covers the determination of specific CO_2 emissions of baseline buildings (premises), associated with the consumption of electricity, fuel, heat, chilled/hot water by buildings (premises) and based on survey. The appendix does not cover emissions associated with replacement of refrigerants.

In Russian regulatory documents, other units of measurement may be used in comparison to the calculation formulas proposed by the methodology. In such cases, the project developer needs to perform the recalculation.

The specific emissions shall be determined for new buildings (premises) and/or for existing buildings (premises). The buildings (premises) shall:

- be classified into different categories, listed in the Appendix 1;

- belong to the same geographical scope, defined by project developer based on their own criterion[64], taking into account:

1) similar climatic conditions;

2) the social-economic conditions of the area where the buildings (premises) are located.

Determination of the specific CO_2 emissions in buildings (premises)

The specific CO_2 emissions are determined based on benchmark using the top-20% best performing buildings. Under this approach, a survey is conducted separately for new and for existing buildings through a sample of similar buildings (premises) that:

- belong to the same building category and

- are located in the same geographical scope.

Data coverage period: by default, activity data of three years are required.

Data currentness: the data currentness shall be no more than two years (the most recent data available shall be used).

Data from existing official surveys[65] may be used if the requirements on data currentness, specified above, are met. Data from the buildings (premises) is collected either through a census of all the buildings (premises) or through a survey using a sampling approach.

The information related to the electricity, fuel, heat, chilled/hot water consumption for new and existing buildings (premises) shall be collected following the requirements of data coverage period as specified above.

[63] Appendix 2 The conservative baseline approach for small and large-scale projects, while similar, is different
[64] Project developer can expand the definition of geographical scope of the spatial extent of the project boundary provided proper justifications and evidences.
[65] For example, data and collections of Rosstat, industry departments, other official surveys

The average specific CO_2 emissions from the top-20% best performing buildings (premises) under the building category i over the applicable data coverage period for new and existing buildings (premises) is determined following the equation below:

$$SE_{CO2,Top20\%,,i} = \frac{\sum_j SE_{CO2,Top20\%,j,i,BL}}{J_{i,BL}} \quad \text{(A2.1)}$$

Where:

$SE_{CO2,Top20\%,,i}$	Average specific CO_2 emissions of the top 20 % performing buildings (premises) in buildings (premises) category i included in the sample over the applicable data coverage period ($tCO_2/(m^2$ year))
$SE_{CO2,Top20\%,j,i,BL}$	Specific CO_2 emissions of buildings (premises) j in the top 20% performing buildings (premises) in buildings (premises) category i included in the sample over the relevant data coverage period ($tCO_2/(m^2$ year))
$J_{i,BL}$	Total number of the top 20 % performing buildings (premises) of buildings (premises) category i in each of the years of the applicable data coverage period, calculated as the product of the number of baseline buildings (premises) in building category i included in the sample and 20 %, rounded up to the next integer if it is decimal[66].

The specific emissions of baseline buildings (premises) j in buildings (premises) category i included in the sample over the applicable data coverage period are determined following the equation below:

$$SE_{j,i,BL} = \frac{BE_{electricity,j,i,BL} + BE_{fuel,j,i,BL} + BE_{water,j,i,BL}}{GFAJ_{j,i,BL}} \quad \text{(A2.2)}$$

Where:

$SE_{j,i,BL}$	Specific CO_2 emissions of baseline buildings (premises) j in buildings (premises) category i included in the sample over the applicable data coverage period ($tCO_2/(m^2$.year))
$BE_{electricity,j,i,BL}$	Baseline emissions from electricity consumption of baseline buildings (premises) j in buildings (premises) category i included in the sample over the applicable data coverage period (tCO_2/year)
$BE_{fuel,j,i,BL}$	Baseline emissions from fossil fuel consumption of baseline buildings (premises) j in buildings (premises) category i included in the sample over the applicable data coverage period (tCO_2/year)
$BE_{water,j,i,BL}$	Baseline emissions from heat, chilled/hot water consumption of baseline buildings (premises) j in buildings (premises) category i included in the sample over the applicable data coverage period (tCO_2/year)
$GFAJ_{j,i,BL}$	GFA of baseline buildings (premises) j in buildings (premises) category i included in the sample over the applicable data coverage period (m^2)

Average baseline CO_2 emissions from electricity consumption

The emissions associated with the consumption of electricity are determined based on the specific electricity consumption from different sources by the buildings (premises) j under the building (premises) category i (new or existing) included in the sample over the applicable data

[66] For example, if the sample size is 22, the number of building units that will comprise the top-20% is 22 x 20% = 4.4, which is rounded up to 5.

coverage period, multiplied by the emission factor of the source providing electricity to the buildings (premises) j, as follows:

$$BE_{electricity,j,i,BL} = \left(EC_{grid,j,i,BL} \times EF_{grid,j,i}\right) + \left(EC_{captive,j,i,BL} \times EF_{captive,j,i}\right) \quad \text{(A2.3)}$$

Where:

$BE_{electricity,j,i,BL}$	Baseline emissions from electricity consumption of baseline buildings (premises) *j* in buildings (premises) category *i* over the applicable data coverage period (tCO_2/year)
$EC_{grid,j,i,BL}$	Grid electricity consumed by the baseline buildings (premises) *j* in buildings (premises) category *i* over the applicable data coverage period (MWh/year)
$EF_{grid,j,i}$	Emission factor of the electric grid supplying electricity to the baseline buildings (premises) *j* in buildings (premises) category *i* (tCO_2e/MWh). The recommended approach to determine the network emission factor is defined in Appendix 9.
$EC_{captive,j,i,BL}$	Captive electricity consumption by the baseline buildings (premises) *j* in buildings (premises) category *i* over the applicable data coverage period (MWh/year)
$EF_{captive,j,i}$	Emission factor of the captive power plant(s) supplying electricity to the baseline buildings (premises) *j* in buildings (premises) category *i* (tCO_2e/MWh). The recommended approach to determine the indirect energy emissions factor for captive use and mini-grid is defined in Appendix 10.

Average baseline CO_2 emissions from fossil fuel consumption

The emissions associated with the consumption of different types of fuel are determined based on the sum of the amounts of fuel type k consumed by the buildings (premises) j, under buildings (premises) category i (new or existing) included in the sample over the applicable data coverage period, multiplied by the fuel's net calorific value and CO_2 emission factor, as follows:

$$BE_{fuel,j,i,BL} = \sum_{k} FC_{k,j,i,BL} \times NCV_k \times EF_{CO2,k} \quad \text{(A2.4)}$$

Where:

$BE_{fuel,j,i,BL}$	Baseline emissions from fossil fuel consumption of baseline buildings (premises) *j* in buildings (premises) category *i* over the applicable data coverage period (tCO_2/year)
$FC_{k,j,i,BL}$	Amount of fossil fuel type *k* consumed by the buildings (premises) *j* in buildings (premises) category *i* over the applicable data coverage period (mass or volume units/year)
NCV_k	Net calorific value of the fossil fuel type *k* (GJ/mass or volume units)
$EF_{CO2,k}$	CO_2 Emission factor of the fuel type k (tCO_2/GJ)

Average baseline CO_2 emissions from heat, chilled/hot water consumption

The emissions associated with the consumption of heat, chilled/hot water are determined based on the energy required to produce the heat, chilled/hot water and on the distribution losses of the distribution networks, as follows:

$$BE_{water,j,i,BL} = \frac{WC_{j,i,BL} \times EF_{WP,j,i,BL}}{1 - \eta_{dist,s,BL}} \tag{A2.5}$$

Where:

$BE_{water,j,i,BL}$	Baseline emissions from heat, chilled/hot water consumption of baseline buildings (premises) *j* in buildings (premises) category *i* over the applicable data coverage period (tCO_2/year)
$WC_{j,i,BL}$	Energy content of the heat, chilled/hot water consumption in baseline buildings (premises) *j* in buildings (premises) category *i* over the applicable data coverage period (GJ/year)
$EF_{WP,j,i,BL}$	Emission factor for production of heat, chilled/hot water that is supplied to baseline buildings (premises) *j* in buildings (premises) category *i* over the applicable data coverage period (tCO_2/GJ)
$\eta_{dist,s,BL}$	Average technical distribution losses of the heating, chilled/hot water systems network serving baseline buildings (premises) *j* in buildings (premises) category *i* over the applicable data coverage period (GJ of technical thermal energy losses in the heat, chilled/hot water distribution networks divided by GJ of thermal energy supplied to the buildings (premises))

The parameter $WC_{j,i,BL}$ can be calculated using heat meters or using mass flow-meters and temperature sensors as indicated in the equations below:

$$WC_{j,i,BL} = m_{j,i,BL} \times \Delta t_{j,i,BL} \times C_m \tag{A2.6}$$

Where:

$m_{j,i,BL}$	Mass of heat, chilled/hot water consumption of baseline buildings (premises) *j* in buildings (premises) category *i* over the applicable data coverage period (kg/year)
$\Delta t_{j,i,BL}$	Average temperature difference between the outlet water and inlet water of the heating, chilled/hot water systems used for the cooling/heating of buildings (premises) *j* in buildings (premises) category *i* over the applicable data coverage period (°C)
C_m	Specific heat capacity of the heat, chilled/hot water (GJ/(kg °C))

If the amount of water is measured using volumetric flow-meters, the mass of water consumed is determined by multiplying the volumetric readings by the density of the water as indicated in the equation below:

$$m_{j,i,BL} = v_{j,i,BL} \times \rho_{H2O} \tag{A2.7}$$

Where:

$v_{j,i,BL}$	Annual heat, chilled/hot water consumption (in volume) of baseline buildings (premises) *j* in buildings (premises) category *I* included in the sample over the applicable data coverage period (m^3/year)
ρ_{H2O}	Density of the chilled/hot water (kg/m^3)

The emission factor for heat, chilled/hot water production ($EF_{WP,j,i,BL}$) shall be calculated for each centralised heating, chilled/hot water systems that supplies the heat, chilled/hot water to the respective buildings (premises) j in buildings (premises)t category i included in the sample over the applicable data coverage period, according to the equation below:

$$EF_{WP,j,i,BL} = \frac{(EC_{WP,s,BL} \times EF_{CO2,s,electricity}) + (\sum_f FC_{WP,k,s,BL} \times NCV_k \times EF_{CO2,k})}{m_{s,BL} \times \Delta t_{s,BL} \times C_m} \quad \text{(A2.8)}$$

Where:

$EC_{WP,s,BL}$	Electricity consumed to produce the heating, chilled/hot water system(s) *s* over the applicable data coverage period (MWh/year)
$EF_{CO2,s,electricity}$	CO_2 emission factor of power source to which the heating, chilled/hot water systems *s* is connected to (tCO_2e/MWh). The recommended approach to determine the network emission factor is defined in Appendix 9.
$FC_{WP,k,s,BL}$	Amount of fossil fuel type *k* consumed to produce the heating, chilled/hot water systems *s* over the applicable data coverage period (mass or volume unit/year)
NCV_k	Net calorific value of the fossil fuel k (GJ/mass or volume unit)
$EF_{CO2,k}$	CO_2 emission factor of the fossil fuel type k (tCO_2/GJ)
$m_{s,BL}$	Mass of chilled/hot water production by heating, chilled/hot water systems *s* over the applicable data coverage period (kg/year)
$\Delta t_{s,BL}$	Average temperature difference between the outlet and inlet of the heat exchangers used for the heat, chilled/hot production in heating, chilled/hot water systems *s* over the applicable data coverage period (°C)
C_m	Specific heat capacity of the chilled/hot water (GJ/(kg . °C))

Appendix 3. Baseline emissions for new buildings and/or for existing buildings

In Russian regulatory documents, other units of measurement may be used in comparison to the calculation formulas proposed by the methodology. In such cases, the project developer needs to perform the recalculation.

A3.1. Steps to calculate baseline emissions for new construction using the top 20 % performance benchmark

Steps to calculate baseline emissions are described in Figure 1 (section 3.3).

A3.1.1. Step 1. Identification of buildings (premises) categories

In the project activity, buildings (premises) can be categorized into different categories. This methodology provides a mandatory list of buildings (premises) categories for use in Appendix 1. The chosen categories shall be clearly presented in the PDD, and remain the same for the entire crediting period(s) unless a request for approval of changes is made in accordance with applicable requirements under changes to registered project activity or programme of activities in the project cycle procedure.

A3.1.2. Step 2. Identification of baseline buildings (premises)

Baseline buildings (premises) shall be identified for each buildings (premises) category i defined in *Step 1*. The baseline buildings (premises) are identified as buildings (premises) in circumstances similar to the buildings (premises) constructed in the project activity (project buildings (premises)). In order to ensure similarity between the baseline and the project buildings (premises), the baseline buildings (premises) shall consist of buildings (premises) in buildings (premises):

1. that do not belong to a registered project activity using this methodology;

2. that are located in the same municipality as the project buildings (premises). If the minimum sample size of baseline buildings (premises) cannot be obtained within the municipality, the project boundary should be extended to cover all neigh bouring municipalities. If the minimum sample size cannot still be obtained, the project boundary should be extended by including the geographical area of the next higher level of administrative boundary. If the sample size still remains below the minimum size, the buildings (premises) category should be excluded;

3. that have been built and then occupied within the five years prior to the start of the project activity;

4. that are located in a region with annual HDD and CDD in a range from 80 % to 120 % of the average value of the region that the project buildings (premises) are located in[67];

5. that are located in an area with similar socio-economic conditions to the one in which the project buildings (premises) are located;

- acceptable data sources on the socio-economic conditions include: (a) income level information collected from a survey; (b) government records on income levels (e.g. for tax purposes); (c) relevant studies or publications on income levels; and/or (d) property prices per square metre as a proxy for income levels. If no data or only limited data is publicly available on the socio-economic conditions, a survey can be conducted. The survey may limit its scope to buildings (premises) that have been built in the project boundary within the five years prior to the start of the project activity[68]. A minimum of three socio-economic classes should be defined based on the level of income or property price (e.g. low, middle, and high income/property price groups). The approaches and underlying assumptions used to distinguish the socio-economic classes shall be transparently documented in the PDD;

- in case buildings (premises) of a specific socio-economic class are concentrated in distinct areas, the baseline buildings (premises) shall be chosen from areas with the same socio-economic class(es) as the project buildings (premises);

- in case buildings (premises) with two or more socio-economic classes are located in the same area, individual buildings (premises) need to be surveyed and buildings (premises) of the same socio-economic class as the project buildings (premises) shall be chosen. Alternatively, such an area with mixed socio-economic classes may be excluded from the baseline buildings (premises) selection as long as the minimum sample size can be obtained from other areas with a distinct socio-economic class;

6. that have a comparable size to the project buildings (premises), defined as the GFA of a baseline buildings (premises) being in the range from 50 % to 150 % of the average GFA of the project buildings (premises) in buildings (premises) category i; similar height or number of floors (low-rise or high-rise), window-to-wall ratio and front façade orientation that can be demonstrated as typical of the project location;

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[67] This requirement is assumed to be determined, ex ante, by observation or review of public open source records but not by baseline building surveys

[68] If income level information is to be collected, a buildings (premises) needs to be occupied at the time of conducting the survey. If property price information is to be collected, it is not necessary for a buildings (premises) to be occupied

7. that are occupied, and used as a primary, year-round residence (applicable only to residential buildings (premises), either in a low-riseor high-rise building);

8. that are operated on annual average at least 30 hours/week (applicable only to categories B.-D. Appendix 1)[69].

The project developer may either choose to identify the baseline buildings (premises) from all the buildings (premises) in the project boundary or use a randomly selected sample of the buildings (premises) in the project boundary.

If the random sampling approach is used, emission reductions can be claimed only if the sample size is larger than the minimum sample size as determined below. However, if the project has fewer buildings (premises) than the minimum sample size in the corresponding buildings (premises) category i, then the equivalent number of baseline buildings (premises) can be used. This minimum number refers to the number of baseline buildings (premises), for which useful monitoring data are available in a particular monitoring time interval. Therefore, to compensate for any possible dropouts from the sample group during the monitoring period, it will be necessary to select an initial sample size. This minimum sample size should be the minimum value between project buildings (premises) in buildings (premises) category i or 20. Project developer may choose any larger sample than the minimum sample size, taking into account the risk of dropouts from the sample group, the overhead costs for monitoring and the effect of reduced statistical errors on account of a larger sample size in calculating emission reductions. Different sample sizes may be selected for each vintage year as long as the sample sizes are larger than the minimum size.

$$n_{BL,min,i,y} = \frac{{cv_{SE,BL,i,y}}^2 \times {t_{0.05}}^2 \times N_{BL,i}}{{P_{10\%}}^2 \times N_{BL,i} + {cv_{SE,BL,i,y}}^2 \times {t_{0.05}}^2} \quad \text{(A3.1)}$$

Where:

$n_{BL,min,i,y}$	Minimum sample size of baseline buildings (premises) in buildings (premises) category i in year y. Round up to the next integer if it is decimal
$cv_{SE,BL,i,y}$	Coefficient of variation of specific emissions of baseline buildings (premises) in buildings (premises) category i in year y
$t_{0.05}$	t-value for a 90 % statistical significance level (1,645)
$P_{10\%}$	10 % precision requirement for a sample estimate (0,10)
$N_{BL,i}$	Total number of baseline buildings (premises) in the population for buildings (premises) category i at the start of the project activity

$$cv_{SE,BL,i,y} = \frac{\sigma_{POP,SE,BL,i,y}}{\mu_{POP,SE,BL,i,y}} \quad \text{(A3.2)}$$

Where:

$cv_{SE,BL,i,y}$	Coefficient of variation of specific emissions of baseline buildings (premises) in buildings (premises) category *i* in year *y*

[69] A buildings (premises) is considered to be in operation for the amount of hours the buildings (premises) is utilized for its main purpose (e.g. office work for an office buildings (premises). The buildings (premises) might as well consume energy in other hours (e.g. standby energy consumption in the buildings (premises) during night time). However, those hours are not counted towards the operating hours

$\sigma_{POP,SE,BL,i,y}$	Expected population standard deviation of specific emissions of baseline buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2/m^2)
$\mu_{POP,SE,BL,i,y}$	Expected population mean of specific emissions of baseline buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2/m^2)

$CV_{SE,BL,i,y}$ is a measure of the expected variation in specific emissions of the population of baseline buildings (premises) in buildings (premises) category i. For the first year, $CV_{SE,BL,i,y}$ can be derived from officially published documents or own non-representative survey, accounting for the same emission sources as ones for the emission reduction calculation of the project activity. However, as necessary information may not be readily available, a default factor of 0.5 is allowed to be used for the first year. For the second year and onwards, $CV_{SE,BL,i,y}$ needs to be replaced by the coefficient of variation of specific emissions of baseline buildings (premises) calculated for the first year ($CV_{SE,PJ,i,1}$).

For the baseline buildings (premises) in buildings (premises) category i, the baseline emissions have to be calculated separately for each buildings (premises) category i for each crediting period year. If the random sampling approach is pursued, project participants shall first establish a list of all buildings (premises) in the project boundary that meet all the relevant criteria for baseline buildings (premises) identification. If a complete list of buildings (premises) cannot be established, project participants shall explain in the PDD reasons for non-availability of certain buildings (premises)and justify why the available buildings (premises) are considered representative of all buildings (premises) in the project boundary. Then, a unique identifier is to be assigned to each buildings (premises) on the list for a random selection of buildings (premises). For example, such a random selection can be performed with common spreadsheet software. The collection of the energy consumption data from the baseline buildings (premises) may require apportionment of the energy consumption if it is monitored only at a whole building level[70]. In this case, such energy consumption has to be apportioned following the procedure existent for the building, showing documented evidence of the procedure and the proof that the procedure has been applied consistently in the last three years. If such procedure is not available, apportion the energy consumption by the GFA that each tenant/owner in the building occupies. Also, the use of a refrigerant(s) monitored only at a whole building level[71] shall also be apportioned by the GFA of the buildings (premises) Such apportionment can be mathematically expressed as follows:

$$X_{BL,i,j,y} = X_{BL-Bldg,i,j,y} \times \frac{GFA_{BL,i,j,y}}{GFA_{BL-Bldg,i,j,y}} \quad \text{(A3.3)}$$

Where:

$X_{BL,i,j,y}$	Baseline energy consumption (electricity, heat, fossil fuel, or chilled water) or baseline emissions related to the use of a refrigerant(s) in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (MWh, mass or volume unit, GJ, or t refrigerant/yr)
$X_{BL-Bldg,i,j,y}$	Baseline energy consumption (electricity, heat, fossil fuel, or chilled water) or baseline emissions related to the use of a refrigerant(s) in the whole

[70] For example, energy consumption for the operation of a central air conditioning system for a whole building may be metered only at a whole building level.
[71] For example, the refrigerant use in a central air conditioner supplying the entire building

building, which baseline buildings (premises) *j* in buildings (premises) category *i* belongs to, in year *y* (MWh, mass or volume unit, GJ, or t refrigerant/yr)

$GFA_{BL,i,j,y}$ — GFA of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (m^2)

$GFA_{BL-Bldg,i,j,y}$ — GFA of the whole building, which baseline buildings (premises) *j* in buildings (premises) category *i* belongs to, in year *y*. Account for GFA of each premises in the building, but not GFA of the common service areas outside the physical boundaries of the premises (m^2)

A3.1.3. Step 3. Calculation of emissions of each baseline buildings (premises)

Calculate the annual emissions of each baseline buildings (premises) j in buildings (premises) category i identified in Step 2. For the sake of simplification and conservativeness, the relevant emissions source(s) can be excluded from the calculation of the baseline emissions during the time period for which relevant data is not available.

$$BE_{i,j,y} = BE_{EC,i,j,y} + BE_{FC,i,j,y} + BE_{WC,i,j,y} + BE_{ref,i,j,y} \quad \text{(A3.4)}$$

Where:

$BE_{i,j,y}$ — Baseline emissions of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/yr)

$BE_{EC,i,j,y}$ — Baseline emissions from electricity consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)

$BE_{FC,i,j,y}$ — Baseline emissions from fossil fuel consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)

$BE_{WC,i,j,y}$ — Baseline emissions from chilled/hot water consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)

$BE_{ref,i,j,y}$ — Baseline emissions from the use of a refrigerant(s) in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/yr)

If it is justified that the project activity does not result in an increase of emissions from the use of refrigerant(s) in buildings (premises) and the project emissions from the use of a refrigerant(s) is omitted from the calculation of the project emissions, $BE_{ref,i,j,y}$ shall be excluded. The project developer should explain and document in the PDD the reasons for eliminating the estimate of emissions from the use of a refrigerant(s).

Calculation of baseline emissions from electricity consumption ($BE_{EC,i,j,y}$)

The baseline emissions from electricity consumption of baseline buildings (premises) j in buildings (premises) category i ($BE_{EC,i,j,y}$) are divided into the following two components:

$$BE_{EC,i,j,y} = BE_{EC,non-REcaptive,i,j,y} + BE_{EC,REcaptive,i,j,y} \quad \text{(A3.5)}$$

Where:

$BE_{EC,i,j,y}$ — Baseline emissions from electricity consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)

$BE_{EC,non-REcaptive,i,j,y}$ — Baseline emissions from electricity consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y*, which are supplied by the grid and/or an off-grid fossil-fuel-fired captive power plants (t CO_2/yr)

$BE_{EC,REcaptive,i,j,y}$	Baseline emissions from electricity consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y*, which are supplied by an off-grid renewable captive power plants ($t\ CO_2/yr$)

Baseline emissions from electricity consumption by base buildings (premises) may be calculated differently according to the sources of electricity generation (from the grid, from an local / off-grid captive power plant, from the grid and fossil fuel fired local / captive power plant)[72].

$BE_{EC,REcaptive,i,j,y}$ equals 0 ($t\ CO_2/yr$) as a conservative simplification.

Calculation of baseline emissions from fuel consumption ($BE_{FC,i,j,y}$)

The baseline emissions from fossil fuel consumption of baseline buildings (premises) j in buildings (premises) category i in year y ($BE_{FC,i,j,y}$) shall be calculated as follows:

$$BE_{FC,i,j,y} = \sum_k FC_{BL,i,j,k,y} \times COEF_{k,y} \tag{A3.6}$$

Where:

$BE_{FC,i,j,y}$	Baseline emissions from fossil fuel consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* ($t\ CO_2/yr$)
$FC_{BL,i,j,k,y}$	Annual consumption of fossil fuel type *k* of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y*. The amount of fuel used for the electricity generation by the captive power plant in the building(s) that baseline buildings (premises) *j* belongs to shall not be included in the parameter (mass or volume unit/yr)
$COEF_{k,y}$	CO_2 emission coefficient of fuel type *k* in year *y* ($t\ CO_2$/mass or volume unit)

The CO_2 emission coefficient $COEF_{k,y}$ can be calculated using one of the following two options.

Option A should be the preferred approach, if the necessary data is available

Option A. *The CO_2 emission coefficient $COEF_{k,y}$ is calculated based on the ultimate analysis of the fossil fuel type k, using the following approach*:

If $FC_{BL,i,j,k,y}$ is measured in a mass unit:

$$COEF_{k,y} = w_{C,k,y} \times 44/12 \tag{A3.7}$$

If $FC_{BL,i,j,k,y}$ is measured in a volume unit:

$$COEF_{k,y} = w_{C,k,y} \times \rho_{k,y} \times 44/12 \tag{A3.8}$$

Where:

$COEF_{k,y}$	CO_2 emission coefficient of fuel type *k* in year *y* ($t\ CO_2$/mass or volume unit)

[72] The recommended approach to determine the network emission factor is defined in Appendix 9. The recommended approach to determine the indirect energy emissions factor for captive use and mini-grid is defined in Appendix 10.

$w_{C,k,y}$	Mass fraction of carbon in fuel type *k* in year *y* (t C/mass unit of the fuel)
$\rho_{k,y}$	Density of fuel type *k* in year *y* (mass unit/volume unit of the fuel)

Option B. *The CO_2 emission coefficient $COEF_{k,y}$ is calculated based on the net calorific value and CO_2 emission factor of the fuel type k, using the following approach*:

$$COEF_{k,y} = NCV_{k,y} \times EF_{CO2,k,y} \quad \text{(A3.9)}$$

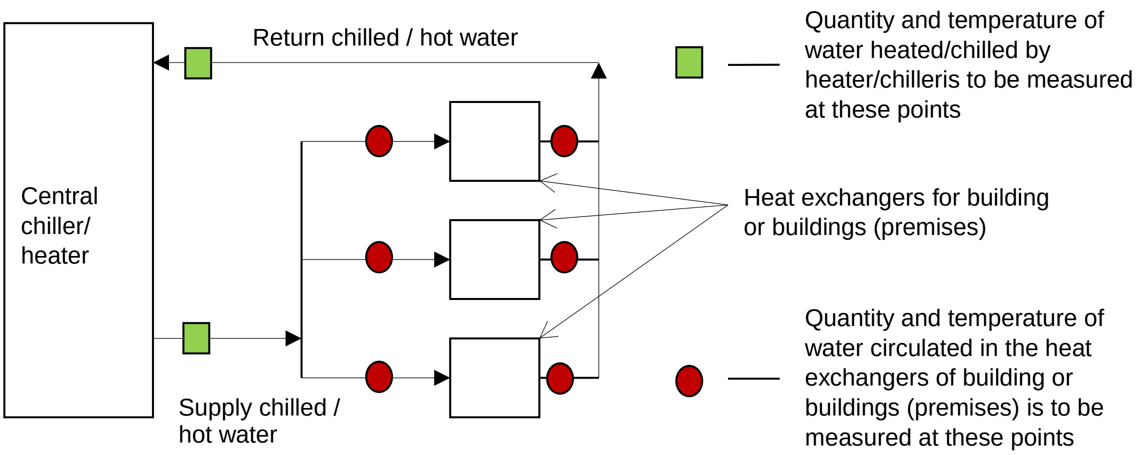
Where:

$COEF_{k,y}$	CO_2 emission coefficient of fuel type *k* in year *y* (t CO_2/mass or volume unit)
$NCV_{k,y}$	Average net calorific value of fossil fuel type *k* used in year *y* (GJ/mass or volume unit)
$EF_{CO2,k,y}$	CO_2 emission factor of fossil fuel type *k* in year *y* (GJ/mass or volume unit)

Calculation of baseline emissions from heat, chilled/hot water consumption ($BE_{WC,i,j,y}$)

The heating, chilled/hot water systems for baseline buildings (premises) applicable under this methodology should have following configuration. The equations are derived considering this configuration in account.

Figure A3.1. The applicable configuration of heating, chilled/hot water systems



The baseline emissions from chilled/hot water consumption of baseline buildings (premises) j in buildings (premises) category i in year y ($BE_{WC,i,j,y}$) shall be calculated as follows:

$$BE_{WC,i,j,y} = \frac{WC_{BL,i,j,y} \times EF_{BL,WP,i,j,y}}{1 - \eta_{BL,dist,l,y}} \quad \text{(A3.10)}$$

Where:

$BE_{WC,i,j,y}$	Baseline emissions from heat, chilled/hot water consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)
$WC_{BL,i,j,y}$	Energy content of annual heat, chilled/hot water consumption in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/yr)

$EF_{BL,WP,i,j,y}$	Emission factor for production of heat, chilled/hot water that is supplied to baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/GJ)
$\eta_{BL,dist,l,y}$	Average technical distribution losses of the heating, chilled/hot water systems *l* networks serving baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ of technical thermal energy losses in the heat, chilled/hot water distribution networks divided by GJ of thermal energy supplied to the buildings (premises))

If a heat meters are installed for monitoring of the energy content of heat, chilled/hot water consumed in the baseline buildings (premises) j (or centrally in the building that the baseline buildings (premises) belongs to), $WC_{BL,i,j,y}$ can be derived directly from the meter reading. If only a mass or volume flow meter(s) and temperature indicators are installed, $WC_{BL,i,j,y}$ is calculated according to the following equations:

$$WC_{BL,i,j,y} = m_{BL,i,j,y} \times \Delta t_{BL,i,j,y} \times C_m \quad \text{(A3.11)}$$

Where:

$WC_{BL,i,j,y}$	Energy content of annual heat, chilled/hot water consumption in baseline buildings (premises) *j* in buildings (premises)category *i* in year *y* (GJ/yr)
$m_{BL,i,j,y}$	Annual heat, chilled/hot water consumption (in mass) of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (kg/yr)
$\Delta t_{BL,i,j,y}$	Average temperature difference between the outlet and inlet of the heat exchanger used for the cooling/heating of buildings (premises) *j* in buildings (premises) category *i* in year *y* (ºC)
C_m	Specific heat capacity of chilled/hot water (GJ/(kg ºC))

In case a volumetric flow meter, and not a mass flow meter, is installed, $m_{BL,i,j,y}$ is calculated using the following equation:

$$m_{BL,i,j,y} = v_{BL,i,j,y} \times \rho_{H2O} \quad \text{(A3.12)}$$

Where:

$v_{BL,i,j,y}$	Annual chilled/hot water consumption (in volume) of baseline buildings (premises)*j* in buildings (premises) category *i* in year *y* (m^3/yr)
ρ_{H2O}	Density of the chilled/hot water (kg/m^3)

The emission factor for heat, chilled/hot water production ($EF_{BL,WP,i,j,y}$) shall be calculated for each centralised heating, chilled/hot water system(s) *l* that supplies the heat, chilled/hot water to the respective buildings (premises) j in buildings (premises) category i in year y, according to the following equation:

$$EF_{BL,WP,i,j,y} = \frac{BE_{WP,EC,l,y} + BE_{WP,FC,l,y} + BE_{WP,FE,l,y}}{WP_{BL,l,y}} \quad \text{(A3.13)}$$

Where:

$EF_{BL,WP,i,j,y}$	Emission factor for production of heat, chilled/hot water that is supplied to baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/GJ)

$BE_{WP,EC,l,y}$	Baseline emissions from electricity consumption of heating, chilled/hot water systems *l* in year *y* (t CO_2/yr)
$BE_{WP,FC,l,y}$	Baseline emissions from fuel consumption of heating, chilled/hot water systems *l* in year *y* (t CO_2/yr ; in case all or part of the heat consumed in heating, chilled/hot water systems *l* is supplied by fossil fuel)
$BE_{WP,FE,l,y}$	Baseline fugitive emissions of CO_2 and methane due to release of non-condensable gases from geothermal sources in heat, chilled/hot water production in heating, chilled/hot water system(s) *l* in year *y* (t CO_2/yr; in case all or part of the heat consumed in heating, chilled/hot water systems *l* is supplied by a geothermal source)
$WP_{BL,l,y}$	Energy content of annual heat, chilled/hot water produced by heating, chilled/hot water systems *l* in year *y* (GJ/yr)

If a heat meters is/are installed for monitoring of the energy content of heat, chilled/hot water production in the chilled/hot water cooling system l, $WP_{BL,l,y}$ can be derived directly from the meter reading. If only a mass or volume flow meters is installed, $WP_{BL,l,y}$ is calculated according to the following equations:

$$WP_{BL,l,y} = m_{BL,l,y} \times \Delta t_{BL,l,y} \times C_m \quad \text{(A3.14)}$$

Where:

$WP_{BL,l,y}$	Energy content of annual heat, chilled/hot water production of heating, chilled/hot water systems *l* in year *y* (GJ/yr)
$m_{BL,l,y}$	Annual heat, chilled/hot water production (in mass) of heating, chilled/hot water systems *l* in year *y* (kg/yr)
$\Delta t_{BL,l,y}$	Average temperature difference between the outlet and inlet of the heat exchangers used for the heat, chilled/hot water production in heating, chilled/hot water systems *l* in year *y* (ºC)
C_m	Specific heat capacity of the chilled/hot water (GJ/(kg ºC))

In case a volumetric flow meter, and not a mass flow meter, is installed, $m_{BL,l,y}$ is calculated using the following equation:

$$m_{BL,l,y} = v_{BL,l,y} \times \rho_{H2O} \quad \text{(A3.15)}$$

Where:

$m_{BL,l,y}$	Annual chilled/hot water production (in mass) of heating, chilled/hot water systems *l* in year *y* (kg/yr)
$v_{BL,l,y}$	Annual heat, chilled/hot water production (in volume) of heating, chilled/hot water systems *l* in year *y* (m^3/yr)
ρ_{H2O}	Density of the chilled/hot water (kg/m^3)

The electricity consumption of heating, chilled/hot water systems include the consumption all electrical equipment as a part of central heating, chilled/hot water systems for example compressor, pumps etc. Baseline emissions from electricity consumption of heating, chilled/hot water systems may be calculated differently according to the sources of electricity generation (from the grid, from an local / off-grid captive power plant, from the grid and fossil fuel fired local / captive power plant)[73].

The baseline emissions from fossil fuel consumption of heating, chilled/hot water systems l in year y ($BE_{WP,FC,l,y}$) are calculated as follows:

$$BE_{WP,FC,l,y} = \sum_{k} FC_{BL,l,k,y} \times COEF_{k,y} \quad \text{(A3.16)}$$

Where:

$BE_{WP,FC,l,y}$	Baseline emissions from fossil fuel consumption of heating, chilled/hot water systems *l* in year *y* (t CO_2/yr)
$FC_{BL,l,k,y}$	Quantity of fossil fuel type *k* fired in heating, chilled/hot water systems *l* in year *y* (mass or volume unit/yr)
$COEF_{k,y}$	CO_2 emission coefficient of fuel type *k* in year *y* (t CO_2/mass or volume unit)

The CO_2 emission coefficient $COEF_{k,y}$ shall be calculated following the same procedures as in the calculation of $BEFC_{i,j,y}$ above using either Option A or B (equations (A3.7) to (A3.9)).

In case all or part of the heat consumed in heating, chilled/hot water system(s) *l* is supplied by a geothermal source, the fugitive emissions from these sources are calculated as follows:

$$BE_{WP,FE,l,y} = \left[w_{BL,steam,CO2,l,y} + \left(w_{BL,steam,CH4,l,y} \times GWP_{CH4}\right)\right] \times M_{BL,steam,l,y} \quad \text{(A3.17)}$$

Where:

$BE_{WP,FE,l,y}$	Baseline fugitive emissions of CO_2 and methane due to release of non-condensable gases from geothermal sources in heat, chilled/hot water production in heating, chilled/hot water systems *l* in year *y* (t CO_2/yr)
$w_{BL,steam,CO2,l,y}$	Average mass fractions of carbon dioxide in the produced geothermal steam for the use in heating, chilled/hot water systems *l* in year *y* (t CO_2/t steam)
$w_{BL,steam,CH4,l,y}$	Average mass fractions of methane in the produced geothermal steam for the use in heating, chilled/hot water systems *l* in year *y* (t CH_4/t steam)
GWP_{CH4}	Global Warming Potential of methane valid for the relevant commitment project period (t CO_2e/t CH_4)
$M_{BL,steam,l,y}$	Quantity of geothermal steam produced for the use in heat, chilled/hot water cooling systems *l* in year *y* (t/yr)

Calculation of baseline emissions from the use of a refrigerant(s) ($BE_{ref,i,j,y}$)

The emissions from the use of a refrigerant(s) in baseline buildings (premises) j in buildings (premises) category i in year y ($BE_{ref,i,j,y}$) shall be calculated as follows:

[73] The recommended approach to determine the network emission factor is defined in Appendix 9. The recommended approach to determine the indirect energy emissions factor for captive use and mini-grid is defined in Appendix 10.

$$BE_{ref,i,j,y} = \sum_{m}(Q_{BL,ref,i,j,m,y} \times GWP_{BL,ref,i,j,m,y}) + BE_{WP,ref,l,y} \times \frac{WC_{BL,i,j,y}}{(1 - \eta_{BL,dist,l,y}) \times WP_{BL,l,y}} \quad \text{(A3.18)}$$

Where:

$BE_{ref,i,j,y}$	Baseline emissions from the use of a refrigerant(s) in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/yr)
$Q_{BL,ref,i,j,m,y}$	Annual quantity of refrigerant type *m* used to replace the refrigerant(s) that has leaked in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y*, excluding refrigerant leakage from chilled water system (t refrigerant/yr)
$GWP_{BL,ref,i,j,m,y}$	Global Warming Potential of refrigerant type *m* used in baseline buildings (premises) *j* in buildings (premises)category *i* in year *y* (t CO_2e/t refrigerant)
$WC_{BL,i,j,y}$	Energy content of annual chilled water consumption in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/yr)
$BE_{WP,ref,l,y}$	Baseline emissions from the use of a refrigerant in chilled water system *l* in year *y* (t CO_2/yr)
$\eta_{BL,dist,l,y}$	Average technical distribution losses of the chilled water system *l* in year *y* (GJ of technical thermal energy losses in the chilled water distribution network divided by GJ of thermal energy supplied to the buildings (premises))
$WP_{BL,l,y}$	Energy content of annual chilled water produced by chilled water system *l* in year *y* (GJ/yr)

The baseline emissions from the use of a refrigerant in chilled water system l in year y ($BE_{WPref,l,y}$) are calculated as follows:

$$BE_{WP,ref,l,y} = Q_{BL,ref,l,y} \times GWP_{BL,ref,l,y} \quad \text{(A3.19)}$$

Where:

$BE_{WP,ref,l,y}$	Baseline emissions from the use of a refrigerant in chilled water system *l* in year *y*(t CO_2/yr)
$Q_{BL,ref,l,y}$	Average annual quantity of the refrigerant used to replace the refrigerant that has leaked in chilled water system *l* in year *y* (t refrigerant/yr)
$GWP_{BL,ref,l,y}$	Global Warming Potential of the refrigerant used in chilled water system *l* in year *y*(t CO_2e/t refrigerant)

Calculation of specific emissions of baseline buildings (premises)

Calculate the specific emissions (SE) of baseline buildings (premises) j in buildings (premises) category i in year y, defined as emissions per GFA in square metre per year:

$$SE_{BL,i,j,y} = \frac{BE_{i,j,y}}{GFA_{BL,i,j,y}} \quad \text{(A3.20)}$$

Where:

$SE_{BL,i,j,y}$	Specific emissions of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y*, defined as emissions per GFA in square metre per year (t $CO_2e/(m^2 \cdot yr)$)
$BE_{i,j,y}$	Baseline emissions of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y*(t CO_2e/yr)
$GFA_{BL,i,j,y}$	GFA of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (m^2)

A3.1.4. Step 4. Calculation of the top 20 % benchmark for specific emissions of baseline buildings (premises)

Selection of the top 20 % performer buildings (premises)

The building energy efficiency levels stipulated in the Order of the Ministry of Construction and Housing and Communal Services of the Russian Federation of November 17, 2017 № 1550 / pr "On approval of the requirements for the energy efficiency of buildings, structures, structures"[74] (the «standard») shall be the basis of the calculation of $SE_{Top20\%,i,y}$.

Sort the group of the baseline buildings (premises) from the lowest to the highest specific energy consumption (SE). Identify the top 20 % performer buildings (premises) j as the buildings (premises) with the 1st to Jth lowest SE, where J (the total number of top 20 % performer buildings (premises) j) is calculated as the product of the number of baseline buildings (premises) monitored and 20 %, rounded down to the next integer if it is decimal.

Calculation of top 20 % benchmark

The energy efficiency levels of buildings, as defined in standard for energy efficiency of buildings, can be the basis for calculating $SE_{Top20\%,i,y}$:

$$SE_{Top20\%,i,y} = EI_{Standard,i,y} \times CI_{Top20\%,i,y} + REFI_{Top20\%,i,y} \quad \text{(A3.21)}$$

Where:

$SE_{Top20\%,i,y}$	Specific emissions of top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y*, defined as emissions per *GFA* in square metre per year (t $CO_2e/(m^2 \cdot yr)$)
$EI_{Standard,i,y}$	Energy efficiency of buildings (premises) in buildings (premises) category *i* stipulated in an applicable and enforced «standard»[75] on building energy efficiency ($MWh/(m^2 \cdot yr)$)
$CI_{Top20\%,i,y}$	Average carbon intensity of energy used in the top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$REFI_{Top20\%,i,y}$	Specific emissions from the use of a refrigerant(s) in the top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y* (t $CO_2e/(m^2 \cdot yr)$)

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[74] The project developer should keep in mind that the normative document given in the text can be changed or canceled

[75] See Order of the Ministry of Construction and Housing and Communal Services of the Russian Federation (17.11.2017 №1550) / pr "On approval of the requirements for the energy efficiency of buildings, constructions, structures". For buildings of different categories, different specific consumption requirements are established, which are mandatory for all types of buildings, except for individual building. The project developer needs to perform the recalculation the units of measurement

The average carbon intensity of energy used in the top 20 % performer buildings (premises) ($CI_{Top20\%,i,y}$) is calculated as follows:

$$CI_{Top20\%,i,y} = \frac{\sum_j CI_{Top20\%,i,j,y}}{J_{i,y}} \qquad \text{(A3.22)}$$

Where:

$CI_{Top20\%,i,y}$	Average carbon intensity of energy used in the top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$CI_{Top20\%,i,j,y}$	Carbon intensity of energy used in top 20 % performer buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$J_{i,y}$	Total number of top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/yr). It is calculated as the product of the number of baseline buildings (premises) monitored in building category *i* and 20 %, rounded down to the next integer if it is decimal

$CI_{Top20\%,i,j,y}$ is a subset of carbon intensity of energy used in baseline buildings (premises) j in buildings (premises) category i in year y ($CI_{BLi,j,y}$), which is calculated as follows:

$$CI_{BL,i,j,y} = \frac{BE_{EC,i,j,y} + BE_{FC,i,j,y} + BE_{WC,i,j,y}}{EC_{BL,i,j,y} + \left(\sum_k FC_{BL,i,j,k,y} \times NCV_{k,y} + WC_{BL,i,j,y}\right) \times 0.2778} \qquad \text{(A3.23)}$$

Where:

$CI_{BL,i,j,y}$	Carbon intensity of energy used in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$BE_{EC,i,j,y}$	Baseline emissions from electricity consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)
$BE_{FC,i,j,y}$	Baseline emissions from fossil fuel consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)
$BE_{WC,i,j,y}$	Baseline emissions from chilled/hot water consumption of baseline buildings (premises)t *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)
$EC_{BL,i,j,y}$	Electricity consumption of baseline buildings (premises) *j* in buildings (premises) category *i*in year *y* (MWh/yr)
$FC_{BL,i,j,k,y}$	Annual consumption of fossil fuel type *k* of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y*. The amount of fuel used for the electricity generation by the captive power plant(s) that project buildings (premises) *j* belongs to shall not be included in the parameter (mass or volume unit/yr)
$NCV_{k,y}$	Average net calorific value of fossil fuel type k used in year *y* (GJ/mass or volume unit)
$WC_{BL,i,j,y}$	Energy content of annual chilled/hot water consumption in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/yr)
0.2778	A multiplication factor used to convert GJ to MWh

The average specific emissions from the use of a refrigerant(s) in the top 20 % performer buildings (premises) ($REFI_{Top20\%,i,y}$) is calculated as follows:

$$REFI_{Top20\%,i,y} = \frac{\sum_j REFI_{Top20\%,i,j,y}}{J_{i,y}} \quad (A3.24)$$

Where:

$REFI_{Top20\%,i,y}$	Average specific emissions from the use of a refrigerant(s) in the top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$REFI_{Top20\%,i,j,y}$	Specific emissions from the use of a refrigerant(s) in top 20 % performer buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$J_{i,y}$	Total number of top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/yr). It is calculated as the product of the number of baseline buildings (premises) monitored in building category *i* and 20 %, rounded down to the next integer if it is decimal

$REFI_{Top20\%,i,j,y}$ is a subset of specific emissions from the use of a refrigerant(s) in baseline buildings (premises) j in buildings (premises) category iin year y ($REFI_{BLi,j,y}$), which is calculated as follows:

$$REFI_{BL,i,j,y} = \frac{BE_{ref,i,j,y}}{GFA_{BL,i,j,y}} \quad (A3.25)$$

Where:

$REFI_{BL,i,j,y}$	Specific emissions from the use of a refrigerant(s) in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$BE_{ref,i,j,y}$	Baseline emissions from the use of a refrigerant(s) in baseline buildings (premises)*j* in buildings (premises) category *i* in year *y* (t CO_2e/yr)
$GFA_{BL,i,j,y}$	GFA of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (m^2)

If a sample of buildings (premises) in the project boundary is monitored as baseline buildings (premises), the calculated $CI_{Top20\%,i,y}$ and $REFI_{Top20\%,i,y}$ shall be conservatively adjusted for the sampling error. Namely, the adjustment requires $CI_{Top20\%,i,y}$ and $REFI_{Top20\%,i,y}$ to be the lower-bound value of the confidence interval established around the average CI and REFI of the top 20 % performer buildings (premises) at a 90 % significance level. This sample error adjustment is performed by a bootstrap method. First, create resamples of $CI_{BL,i,j,y}$ and $REFI_{BL,i,j,y}$ by repeatedly sampling at random and with replacement from the original sample of $CI_{BL,i,j,y}$ and $REFI_{BL,i,j,y}$. Each resample is the same size as the original sample and the minimum size of the resamples is 1000. Second, create bootstrap distributions calculating $CI_{Top20\%,i,y}$ and $REFI_{Top20\%,i,y}$ for each resample according to the equations (A3.22) and (A3.24). Lastly, the sample-error-adjusted $CI_{Top20\%,i,y}$ and $REFI_{Top20\%,i,y}$ are the values of $CI_{Top20\%,i,y}$ and $REFI_{Top20\%,i,y}$ at the 5th percentile of the corresponding bootstrap distribution.

A3.1.5. Step 5a. Calculation of baseline emissions based on the top 20 % benchmark

Based on the top 20 % benchmark SE determined above, the baseline emissions are calculated by multiplying the top 20 % benchmark SE by the total GFA of the project buildings (premises) in the corresponding buildings (premises) category i. Accordingly, the total baseline emissions are calculated as follows:

$$BE_y = \sum_i SE_{Top20\%,i,y} \times GFA_{PJ,i,y} \times CF_{BL,i,y} \times DISC_{i,y} \quad \text{(A3.26)}$$

Where:

BE_y	Baseline emissions of baseline buildings (premises) in year *y* (t CO_2e/yr)
$SE_{Top20\%,i,y}$	Specific emissions of top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y*, defined as emissions per unit *GFA* (in square meter) per year (t CO_2e/(m^2·yr))
$GFA_{PJ,i,y}$	Total *GFA* of project buildings (premises) in buildings (premises) category *i* in year *y* (m^2)
$CF_{BL,i,y}$	Baseline correction factor for occupancy of project buildings (premises) in buildings (premises) category *i* in year *y*
$DISC_{i,y}$	Discount factor for double-counting of emissions reductions due to overlapping use of efficient appliances in buildings (premises) category *i* in year *y*

The discount factor ($DISC_{i,y}$) is calculated as follows:

$$DISC_{i,y} = 1 - \sum_n \frac{APPL_{RFu,n,y}}{APPL_{RFs,n,y}} \times ESHARE_{i,n} \quad \text{(A3.27)}$$

Where:

$DISC_{i,y}$	Discount factor for double-counting of emissions reductions due to overlapping use of efficient appliances *in* buildings (premises) category *i* in year *y*
$APPL_{RFu,n,y}$	Total number of efficient appliances of type *n* that are used in registered project(s) in the Russian Federation in year *y*
$APPL_{RFs,n,y}$	Total number of efficient appliances of type *n* that are sold in the Russian Federation in year *y*
$ESHARE_{i,n}$	Default share of energy use of efficient appliances of type *n* in the total building energy consumption in buildings (premises) category *i* in year *y*

The baseline correction factor for occupancy of project buildings (premises) ($CF_{BL,i,y}$) is set to 1 (one) if all the buildings (premises) in the project boundary are monitored as project buildings (premises). If a sample of buildings (premises) in the project boundary is monitored as project buildings (premises), $CF_{BL,i,y}$ shall be calculated as follows:

$$CF_{BL,i,y} = 1 - \lambda_{PJ,i,y} \quad \text{(A3.28)}$$

Where:

$CF_{BL,i,y}$	Baseline correction factor for occupancy of project buildings (premises) in buildings (premises) category *i* in year *y*
$\lambda_{PJ,i,y}$	Share of buildings (premises) not meeting the occupancy criterion for project buildings (premises) in buildings (premises) category *i* in year *y*

$$\lambda_{PJ,i,y} = \frac{n_{PJ,UNO,i,y}}{n_{PJ,i,y}} \quad (A3.29)$$

Where:

$\lambda_{PJ,i,y}$	Share of buildings (premises) not meeting the occupancy criterion for project buildings (premises) in buildings (premises) category *i* in year *y*
$n_{PJ,UNO,i,y}$	Total number of project buildings (premises) not satisfying the occupancy criterion in the sample for buildings (premises) category *i* in year *y*. See Step 2 Appendix 6 (Identification of project buildings (premises)) for the occupancy criterion
$n_{PJ,i,y}$	Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

A3.1.6. Step 5b. Modelling baseline emissions

For each building category, the baseline emissions of new construction can also be determined using a whole building computerized simulation tool to generate energy use using weather data and building occupancy of the project buildings, which are monitored during each year of the crediting period.

Baseline emissions associated with the use of a refrigerant(s) shall be accounted for using calculation procedures described in *Calculation of baseline emissions from the use of a refrigerant(s)* above.

The model base building settings shall exclude all measures that have not been deemed to be common practice (such as improved physical characteristics and properties of subject buildings (premises), improved efficiency of equipment and appliances).The model's tenancy-related settings (T-settings) related to operating pattern (e.g. hours of operation), building control strategies and occupancy (e.g. number of occupants) of baseline buildings (premises) as well as weather data shall match those in the calibrated model of the project buildings (premises).

To model baseline emissions, two options are available to project participants:

***Option 1*. Modelling baseline emissions based on the top 20 % benchmark (*Option 2.1*, section 3.3)**

Baseline emissions of the buildings (premises) in building category i are calculated using a calibrated whole building model of the subject baseline buildings (premises) in building category i. The B-settings of the modelshall refer to physical characteristics of top 20 % best performing buildings selected as baseline buildings following Step 1 and 2, described above.

Energy performance requirements stipulated in the applicable and enforced standard on building energy efficiency shall be taken into account when energy consumption and associated baseline emissions based on the top 20 % benchmark are calculated in Step 5a and these shall be used as input parameters in the whole building model of the baseline buildings (premises) in building category i.

The baseline model's weather, and T-settings shall match those in the calibrated model of the project activity building(s) (see section 7).

***Option 2*. Modelling baseline emissions based on baseline building characteristics obtained through interviews of experts** (**Option 2.2, section 3.3)**

Baseline emissions of the buildings (premises) in building category i are calculated using a calibrated whole building model of the subject baseline buildings (premises) in building category

i. The B settings of the model shall refer to physical characteristics of baseline buildings (premises) in building category i. Physical characteristics can be obtained from interviews with five construction companies or experts (such as a third party architect or Chartered Engineer) that shall provide information on construction materialsand their physical characteristics (such as U-values), construction practices, types of insulation, windows, doors, etc., that were most commonly used in the last five years. This information shall be supported by evidence (such as studies conducted by third party or construction documentation). If different construction companies or experts provide different quotes of most commonly used materials and construction practices, the most conservative option shall be selected as the baseline characteristic.

A3.1.7. Step 6. Update of the baseline emission calculation

The total GFA of project buildings (premises) in buildings (premises) category i in year y ($GFA_{PJ,i,y}$) has to be updated at least every third year (e.g. year 4, 7, 10), or more frequently, in order to reflect the change in the scale of the project activity over time.

In order to reflect the changes in the energy consumption patterns of the baseline buildings (premises) over time, baseline emissions shall be updated annually during project implementation, for which the *Options 1* and *2* below are available. However, for project activities that apply conservative approach to baseline estimation, this requirement (i.e. annual update of the baseline emissions) is not applicable (see Appendix 2).

***Option 1*. Annual monitoring of electricity consumption, fuel consumption and energy content of annual chilled/hot water consumption of baseline buildings (premises) j in buildings (premises) category i**

This option is applicable when project participants selected to follow Step 5a. Calculation of baseline emissions based on the top 20 % benchmark.

The relevant data ($EC_{BL,i,j,y}$, $FCBL_{,i,j,k,y}$ and $WCBL_{,i,j,y}$) shall be collected every year from the same baseline buildings (premises) which are included in top 20 % performers identified from the first year after project implementation. If a baseline buildings (premises) in the group of top 20 % is destroyed or its function is changed, it can be replaced by another buildings (premises) in the same buildings (premises) category that is randomly sampled.

The calculation of the baseline emissions from the use of a refrigerant(s) ($BE_{ref,i,j,y}$) shall be updated annually for the buildings (premises) which are included in the top 20 % performers identified from the first year after project implementation. Alternatively, it can be updated for the first three years of the corresponding crediting period, and for any subsequent year in the crediting period, the minimum annual value of the three-year monitoring period can be used.

All the other baseline-related data need to be updated every third year (e.g. year 4, 7, 10) for the baseline buildings (premises) that are included in the 20 % performers identified from the first year after project implementation.

Based on the above data, the baseline emissions shall be updated annually during project implementation for the baseline buildings (premises) which are included in the top 20 % performers identified from the first year after project implementation.

All the steps should be documented transparently, including a list of the baseline buildings (premises) identified, with information to clearly identify the buildings (premises), as well as the relevant data used for the calculation of the baseline emissions.

***Option 2*. Annual update of baseline emissions using a whole building computerized simulation tool**

The baseline emissions from new construction are updated annually using a whole building computerized simulation tool to generate energy use using weather data and building occupancy patterns experienced by the project buildings, which are monitored during each year of the crediting period. Physical characteristics of baseline buildings (premises) in building category i (the B-settings of the model) should not be updated annually and are fixed for the crediting period.

A3.2. Retrofitting existing buildings

Baseline emissions from retrofitting of existing buildings can be determined by applying a whole building computerized simulation (section A3.2.1 below), or, alternatively, by applying a conservative approach to baseline estimation (section A3.2.2 below).

A3.2.1. Application of whole building computerized simulation

For baseline emissions of existing buildings determined using a whole building computerized simulation model, the model has to be calibrated taking into account relevant building characteristics (B-settings) and energy consumption and of the existing building(s) experienced over the recent 12 months prior to their retrofit as well as its operating, building control strategies and occupancy (T-settings) that together with the weather data are experienced during the above period.

Baseline emissions associated with the use of a refrigerant(s) shall be accounted for using calculation procedures described in *Calculation of baseline emissions from the use of a refrigerant(s)* above.

Baseline emissions are calculated using a calibrated whole building model of the subject baseline buildings (premises) in building category i. The model base building settings (B settings) refer to physical characteristics of existing buildings prior to their retrofit. The model base building settings shall exclude all the project activity measures (such as improved physical characteristics and properties of subject buildings (premises), improved efficiency of equipment and appliances).The model tenancy-related settings (T-settings) related to operating pattern (e.g. hours of operation), building control strategies and occupancy (e.g. number of occupants) of subject buildings (premises) as well as weather data shall match those in the calibrated model of the project buildings (premises).

Energy performance requirements stipulated in the standard on building energy efficiency for retrofits shall be used as input parameters in the whole building model of the subject baseline buildings (premises) in building category i when respective energy consumption and associated baseline emissions of existing buildings prior to retrofit are modelled.

The baseline model’s weather, and T-settings shall match those in the calibrated model of the project activity building(s) (see section 7).

A3.2.2. Applying a conservative approach to baseline estimation

If *Option 3*, described in section 3.3 above, was used to calculate the baseline, then the calculations are carried out in accordance with Appendix 2.

Appendix 4. Assessment of the validity of the original/current baseline at the renewal of the crediting period

This appendix describes a procedure to the validity of the original/current baseline at the renewal of the crediting period.

Assessment of the validity of the original/current baseline at the renewal of the crediting period consists of two steps.

A. Assess the validity of the current baseline for the next crediting period.

1. Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies.

If the current baseline is not in compliance with the relevant mandatory national and/or sectoral policies or if it cannot be shown that the policies are systematically not enforced and that non-compliance with those policies is widespread in the country or region, then the current baseline needs to be updated for the subsequent crediting period.

2. Assess the impact of circumstances.

If the new circumstances make a continued validity of the current baseline not plausible, then the current baseline needs to be updated for the subsequent crediting period.

3. Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

If the baseline scenario of the project activity is the continuation of use of the current equipment(s) without any investment and the projects proponents or third party(ies) will undertake an investment later, but before the end of a crediting period, then the current baseline needs to be updated for that crediting period or the crediting of emission reductions should be limited to the period before the baseline equipment would cease its operation.

4. Assessment of the validity of the data and parameters.

If any of the data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore, the current baseline **needs to be updated** for the subsequent crediting period.

If the application of p.1, 2, 3 and 4 confirmed that the current baseline as well as data and parameters are still valid for the subsequent crediting period, then this baseline, data and parameters **can be used for the renewed crediting period**. Otherwise, proceed to Step B.

B. Update the current baseline and the data and parameters.

This step is only applicable if any of the p. 1, 2, 3 and/or 4 showed that the current baseline needs to be updated.

a. Update the current baseline

Update the current baseline emissions for the subsequent crediting period, without reassessing the baseline scenario, based on the latest approved version of the methodology applicable to the project activity. The procedure should be applied in the context of the sectoral policies and circumstances that are applicable at the time of request for renewal of the crediting period.

b. Update the data and parameters

If the application of p.4 showed that the data and/or parameter(s) that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore, project developer should update all applicable data and parameters.

Appendix 5. Data and parameters monitored

General parameters to be monitored as a result of climate project implementation activities.

Table A5.1. Data and parameters monitored (general)

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
1	$BIOGP_{J,y}$	-	Existence of a biogas systems(s) supplying thermal or electrical energy	Building survey	-	For the first year of the project implementation, and every third year thereafter	-	None of the project buildings (premises), that are used for the calculation of project emissions is fed electrical or thermal energy by biogas systems
2	$BIOMP_{J,y}$	-	Existence of a biomass-fired boiler(s) supplying electrical or thermal energy	Building survey	-	For the first year of the project implementation, and every third year thereafter	-	None of the project buildings (premises), that are used for the calculation of project emissions is fed electrical or thermal energy by biomass
3	$COGEN_{PJ,y}$	-	Reception of electrical and/or thermal energy by buildings (premises) of the project from cogeneration systems. Distribution of fuel consumption for electrical and thermal energy	Building survey	-	For the first year of the project implementation, and every third year thereafter	-	It is necessary that the chosen method for allocating fuel consumption does not change during the crediting period
4	$CFC_{PJ,y}$	-	Confirmation that none of the project buildings (premises) used for the calculation of project emissions uses CFC as a refrigerant in year y	Building survey	-	For the first year of the project implementation, and every third year thereafter	-	-

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
5	$OVERL_{PJ,y}$	-	Confirmation that none of the project buildings (premises) used for the calculation of project emissions claims carbon units for emission reductions achieved by using efficient appliances being credited in other project activities registered as projects in year y	the website of The Carbon Units Register of the Russian Federation	Check the website of The Carbon Units Register of the Russian Federation https://carbonreg.ru/ru/projects/, for the presence of registered projects receiving carbon units from the use of efficient appliances. If there is none of such, this applicability condition is deemed satisfied. If there is registered project(s) receiving carbon units from the use of efficient appliances, a discount factor (DISCi,y) shall be applied to the baseline and project emissions in order to satisfy this applicability condition	For the first year of the project implementation, and every third year thereafter	-	-
6	$COMP_{PJ,y}$	-	Compliance of project buildings (premises) with all applicable energy standards, checked in year y after the construction of the project buildings (premises)	Documentary evidence issued by an independent entity	Check if there is an applicable energy standard that is assumed to be enforced in the project boundary. An energy standard is assumed to be enforced if more than 50 % of the buildings (premises) regulated by the standard in the project boundary are in compliance with the standard. This requirement is assumed to be determined by observation or review of public records but not by building occupant surveys. If there is no inspection system in place to check the compliance of buildings, the energy standard can be assumed not enforced. If there is an applicable energy standard that is assumed to be enforced, an independent entity such as a governmental agency or sectoral expert shall check the compliance as regulation. The results shall be verified by validation and verification body at the first verification of	Monitored only in the year in which the project buildings (premises) are constructed	-	-

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
					emission reductions achieved by the relevant project buildings (premises)			
7	$APPL_{RFu,n,y}$	-	Total number of efficient appliances of type n that are used in registered project(s) in Russian Federation in year y	Monitoring reports of respective projects available on the website of The Carbon Units Register of the Russian Federation	If the registered project(s) has not published a monitoring report(s), it is not necessary to account for this parameter	For the first year of the project implementation, and every third year thereafter	-	-
8	$APPL_{RFs,n,y}$	-	Total number of efficient appliances of type n that are sold in Russian Federation in year y	Official statistics, existing relevant study, or own survey	-	For the first year of the project implementation, and every third year thereafter	-	-
9	$\sigma_{POP,SE,BL,i,y}$	t CO_2/m^2	Expected population standard deviation of specific emissions of baseline buildings (premises) in buildings (premises) category i in year y	For the first year: Derived from officially published documents or own non-representative building survey. If a default factor of 0.5 is used for $cv_{SE,BL,i,y}$, there is no need to derive this parameter. For the second year onwards: Use $\sigma_{SE,PJ,i,1}$ as a proxy	-	For the first year of the project implementation, and update the value in the second year for the rest of the crediting period(s)	-	-
10	$\sigma_{POP,SE,PJ,i,y}$	t CO_2/m^2	Expected population standard deviation of specific emissions of project buildings (premises) in buildings (premises) category i in year y	For the first year: Derived from officially published documents or own non-representative building survey. If a default factor of 0.5 is used for $cv_{SE,PJ,i,y}$, there is no need to derive this parameter.	-	For the first year of the project implementation, and update the value in the second year for the rest of the crediting period(s)	-	-

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
				For the second year onwards: Use $\sigma_{SE,PJ,i,1}$ as a proxy				
11	$GFA_{BL,i,j,y}$ or $GFA_{BL-Bldg,i,j,y}$	m^2	1. GFA of baseline buildings (premises) j in buildings (premises)category i in year y; or 2. GFA of the whole building, which baseline buildings (premises) j in buildings (premises)category i belongs to, in year y. Account for GFA of each buildings (premises) in the building, but not GFA of the common service areas	The following data sources may be used: 1. Building plan - this is the preferred source; 2. On-site measurement - If 1) is not available	-	For the first year of the project implementation, and every third year thereafter	1) Confirm on-site that building geometry represented in the plan is accurate; 2) Not applicable	$GFA_{BL-Bldg,i,j,y}$ is applicable only if apportioning of baseline energy consumption and/or baseline emissions related to the use of a refrigerant(s) is required
12	$BE_{EC,non-REcaptive,i,j,y}$	t CO_2/yr	Baseline emissions from electricity consumption of baseline buildings (premises) j in buildings (premises) category i in year y, which is supplied by the grid and/or an off-grid fossil-fuel-fired captive power plant(s)	Project documentation (PDD)	-	Annually	-	-
13	$FC_{BL,i,j,k,y}$ or $FC_{BL-Bldg,i,j,y}$	Mass or volume unit/yr (e.g. tonne/yr or m^3/yr)	1) Annual consumption of fossil fuel type k of baseline buildings (premises) j in buildings (premises) category i in year y; or 2) Annual consumption of fossil fuel type k of the whole building, which baseline	Onsite measurements	Use either mass or volume meters. The ruler gauge must be calibrated at least once a year and have a book of control for recording the measurements	Continuously	Check consistency of the monitored records with the records from previous monitoring intervals. The consistency of metered fuel consumption quantities should be cross-checked by an	$FC_{BL-Bldg,i,j,k,y}$ is applicable only if the fuel consumption is monitored only at a whole building level

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
			buildings (premises) j in buildings (premises) category i belongs to, in year y. In both cases, the amount of fuel used for the electricity generation by the captive power plant(s) in the building that baseline buildings (premises)j belongs to shall not be included in the parameter				annual energy balance that is based on purchased quantities and stock changes.	
14	$w_{C,k,y}$	t C/mass unit of the fuel	Weighted average mass fraction of carbon in fuel type k in year y	The following data sources may be used: 1 values provided by the fuel supplier in invoices (this is the preferred source); 2. measurements by the project developer (if 1. is not available)	Measurements should be undertaken in line with national or international fuel standards	For the first year of the project implementation, and every third year thereafter	Verify if the values under 1. and 2. are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in 2. should have accreditation and justify that they can comply quality standards	Applicable only if Option A is used for the calculation of emissions from fossil fuel consumption in buildings (premises) or heating, chilled/hot water systems and the fuel consumption is measured in a mass unit
15	$\rho_{k,y}$	Mass unit/volume unit of the fuel	Weighted average density of fuel type k in year y	The following data sources may be used: 1. values provided by the fuel supplier in invoices	Measurements should be undertaken in line with national or international fuel standards	For the first year of the project implementation, and every third year thereafter	-	Applicable only if Option A is used for the calculation of emissions from fossil fuel

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
				(this is the preferred source); 2. measurements by the project developer (if 1. is not available); 3. regional or national default value (If 1. is not available). These sources can only be used for liquid fuels and should be based on well documented, reliable sources				consumption in buildings (premises) or heating, chilled/hot water systems and the fuel consumption is measured in a volume unit
16	$NCV_{k,y}$	GJ/mass or volume unit	Average net calorific value of fossil fuel type k used in year y	1. values provided by the fuel supplier in invoices (this is the preferred source); 2. measurements by the project participants (if 1. is not available); 3. regional or national default values (if 1. is not available); 4. IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories (if 1. is not available)	Measurements should be undertaken in line with national or international fuel standards	1. and 2.: the NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated. 3.: annually; 4. any future revision of the IPCC Guidelines should be taken into account	Verify if the values under 1., 2. and 3. are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines	Applicable only if Option B is used for the calculation of emissions from fossil fuel consumption in buildings (premises) or heating, chilled/hot water systems
17	$EF_{CO2,k,y}$	t CO_2/GJ	Weighted average CO_2 emission factor of fossil fuel type k used in year y	1. values provided by the fuel supplier in invoices (this is the preferred source); 2.	Measurements should be undertaken in line with national or international fuel standards	1. and 2.: the NCV should be obtained for each fuel delivery, from	-	-

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
				measurements by the project participants (if 1. is not available); 3. regional or national default values (if 1. is not available); 4. IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories (if 1. is not available)		which weighted average annual values should be calculated. 3.: annually; 4. any future revision of the IPCC Guidelines should be taken into account		
18	$WC_{BL,i,j,y}$ or $WC_{BL\text{-}Bldg,i,j,y}$	GJ/yr	1. Energy content of annual heat, chilled/hot water consumption in baseline buildings (premises) j in buildings (premises) category i in year y; or 2. Energy content of annual heat, chilled/hot water consumption in the whole building, which baseline buildings (premises) j in buildings (premises) category i belongs to, in year y	Choose among the following options: 1. utility billing records; 2. on-site measurements	1. as per the utility metering; 2. use heat meters	1. as per the utility metering; 2. continuously, aggregated at least annually	Check consistency of the monitored records with the records from previous monitoring intervals	Applicable only if a heat meter is installed for monitoring of heat, chilled/hot water consumption. $WC_{BL\text{-}Bldg,i,j,k,y}$ is applicable only if the heat, chilled/hot water consumption is monitored only at a whole building level
19	$\eta_{BL,dist,l,y}$	GJ of technical thermal energy losses in the heat, chilled/hot water	Average technical distribution losses of the heating, chilled/hot water systems l in year y	Monitoring records of thermal energy supply and demand or thermal energy loss measurement. A default value of 0 %	1. Based on monitoring of thermal energy supply and demand; or 2. Measurement and estimation of surface thermal energy losses. Follow authentic engineering handbooks/ publications or national or	For the first year of the project implementation, and every third year thereafter	-	-

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
		distribution networks divided by GJ of thermal energy supplied to the buildings (premises)s		may be used if no recent data are available or the data cannot be regarded accurate and reliable	international standards for calculation of the surface thermal energy losses			
20	$m_{BL,i,j,y}$	kg/yr	Annual chilled/hot water consumption (in mass) of baseline buildings (premises) j in buildings (premises) category i in year y	Choose among the following options: 1. utility billing records; 2. on-site measurements	1. as per the utility metering; 2. use heat meters	1. as per the utility metering; 2. continuously, aggregated at least annually	Check consistency of the monitored records with the records from previous monitoring intervals	Applicable only if a mass flow meter is installed for monitoring of chilled/hot water consumption
21	$v_{BL,i,j,y}$	m^3/yr	Annual heat, chilled/hot water consumption (in volume) of baseline buildings (premises) j in buildings (premises) t category i in year y	Choose among the following options: 1. utility billing records; 2. on-site measurements	1. as per the utility metering; 2. use heat meters	1. as per the utility metering; 2. continuously, aggregated at least annually	Check consistency of the monitored records with the records from previous monitoring intervals	Applicable only if a volume flow meter is installed for monitoring of heat, chilled/hot water consumption
22	$WP_{BL,l,y}$	GJ/yr	Annual energy content of heat, chilled/hot water production of heating, chilled/hot water systems l in year y	On-site measurements	Use heat meters	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a heat meter is installed for monitoring of heat, chilled/hot water production
23	$m_{BL,l,y}$	kg/yr	Annual chilled/hot water production (in mass) of heating, chilled/hot water systems l in year y	On-site measurements	Use mass meters	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a mass flow meter is installed for monitoring of chilled/hot water production
24	$\Delta t_{BL,l,y}$	°C	Average temperature difference between the outlet and inlet of the heat exchangers used for the heat, chilled/hot water production in heating, chilled/hot water systems l in year y	The following data sources may be used: 1. readings taken from temperature meters installed at pipeline of inlet and outlet of the heat exchanger used for the	1. Readings taken from temperature meters installed at pipeline of inlet and outlet of the heat exchanger; 2. Not applicable	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a mass or volume flow meter is installed for monitoring of heat, chilled/hot water production. The temperature meter readings

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
				chilled/hot water supply (this is the preferred source); 2. specification of the manufacturer of the heating, chilled/hot water systems (if 1. is not available)				should be installed at the immediate inlet and outlet points of the heat exchangers of the heating, chilled/hot water systems
25	$v_{BL,l,y}$	m^3/yr	Annual heat, chilled/hot water production (in volume) of heating, chilled/hot water systems l in year y	On-site measurements	Use volume meters	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a volume flow meter is installed for monitoring of heat, chilled/hot water production
26	$BE_{WP,EC,l,y}$	t CO_2/yr	Baseline emissions from electricity consumption of heating, chilled/hot water systems l in year y	On-site measurements	-	For the first year of the project implementation, and every third year thereafter	-	-
27	$FC_{BL,l,k,y}$	Mass or volume unit/yr (e.g. tonne/yr or m^3/yr)	Quantity of fossil fuel type k fired in heating, chilled/hot water systems l in year y	Onsite measurements	Use either mass or volume meters	For the first year of the project implementation, and every third year thereafter	Check consistency of the monitored records with the records from previous monitoring intervals	-
28	$Q_{BL,ref,l,y}$	t refrigerant/yr	Average annual quantity of the refrigerant used to replace the refrigerant that has leaked in chilled water system l in year y	Choose among the following options: 1. inventory data of refrigerant cylinders consumed in the heating, chilled/hot water system(s); 2. assume the low-end default value from Chapter 7: Emissions of fluorinated substitutes for Ozone depleting substances, Volume 3, Industrial Processes and	-	For the first year of the project implementation, and every third year thereafter	Cross-check the quantities of refrigerants consumed with typical leakage rates of the refrigerants for the relevant application	-

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
				Product Use, 2006 IPCC Guidelines for National Greenhouse Gas Inventories				
29	$GWP_{BL,ref,l,y}$	t CO_2e/t refrigerant	Global Warming Potential of the refrigerant used in chilled water system l in year y	values listed in the IPCC's fourth assessment report shall be used	-	For the first year of the project implementation, and every third year thereafter	-	-
30	$w_{BL,steam,CO2,l,y}$	t CO_2/t steam	Average mass fractions of CO_2 in the produced geothermal steam for the use in heating, chilled/hot water systems l in year y	On-site measurements	Non-condensable gases sampling should be carried out in production wells and atthe steam field-power plant	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a geothermal source(s) supplies heat to the heating, chilled/hot water systems
31	$w_{BL,steam,CH4,l,y}$	t CO2/t steam	Average mass fractions of CH_4 in the produced geothermal steam for the use in heating, chilled/hot water systems l in year y	On-site measurements	As per the procedures outlined for $w_{BL,steam,CO2,l,y}$	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a geothermal source(s) supplies heat to the heating, chilled/hot water systems
32	$M_{BL,steam,l,y}$	t/yr	Quantity of geothermal gas produced for the use in heating, chilled/hot water systems l in year y	On-site measurements	The steam quantity discharged from the geothermal wells should be measured with a venturi flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venturi meter is required to define the steam properties. The calculation of steam quantities should be conducted on a continuous basis and should be based on national and international standards. The measurement results should be summarized transparently in regular production reports	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a geothermal source(s) supplies heat to the heating, chilled/hot water systems
33	$Q_{BL,ref,i,j,m,y}$ or $Q_{BL-Bldg,ref,i,j,m,y}$	t refrigerant/yr	1. annual quantity of refrigerant type m used to replace the refrigerant(s) that has leaked in baseline	Choose among the following options: 1. inventory data of refrigerant cylinders consumed in the	-	Annually. Alternatively, only for the first three years of the corresponding	Cross-check the quantities of refrigerants consumed with typical leakage rates of the	$Q_{BL-Bldg,ref,i,j,m,y}$ is applicable only if the refrigerant leakage is monitored only at

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
			buildings (premises) j in buildings (premises) category i in year y, excluding refrigerant leakage from chilled water system; or 2. annual quantity of refrigerant type m used to replace the refrigerant(s) that has leaked in the whole building, which baseline buildings (premises) j in buildings (premises) category i belongs to, in year y, excluding refrigerant leakage from chilled water system	heating, chilled/hot water system(s); 2. assume the low-end default value from Chapter 7: Emissions of fluorinated substitutes for Ozone depleting substances, Volume 3, Industrial Processes and Product Use, 2006 IPCC Guidelines for National Greenhouse Gas Inventories		crediting period, if the minimum annual value of the three-year monitoring period is to be used for the subsequent years in the crediting period	refrigerants for the relevant application	a whole building level
34	$GWP_{BL,ref,i,j,m,y}$	t CO_2e/t refrigerant	Global Warming Potential of refrigerant type m used in baseline buildings (premises) j in buildings (premises) category iin year y	values listed in the IPCC's fourth assessment report shall be used	-	As per the monitoring frequency of $Q_{BL,ref,i,j,m,y}$ or $Q_{BL-Bldg,ref,i,j,m,y}$	-	-
35	$J_{i,y}$	-	Total number of top 20 % performer buildings (premises) in buildings (premises) category i in year y	Building survey	-	Annually	-	-
36	$EI_{Standard,i,y}$	MWh/(m^2·yr) (unit conversion required – Project Developer)	Energy efficiency of buildings (premises) in buildings (premises) category i stipulated in an applicable and enforced «standard» on building energy efficiency	Order of the Ministry of Construction and Housing and Communal Services of the Russian Federation of November 17, 2017 №1550 / pr "On approval of the requirements for the energy efficiency of buildings, structures,	-	Annually	-	-

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
				structures" (can be changed)				
37	$EC_{BL,i,j,y}$ or $EC_{BL-Bldg,i,j,y}$	MWh/yr	1.electricity consumption of baseline buildings (premises) j in buildings (premises) category i in year y;or 2. electricity consumption of the whole building, which baseline buildings (premises) j in buildings (premises) category i belongs to, in year y	Direct measurement or calculated based on measurements from more than one electricity meters	Use electricity meters installed at the electricity consumption sources	Continuous measurement and at least monthly recording	-	$EC_{BL-Bldg,i,j,y}$ is applicable only if the electricity consumption is monitored only at a whole building level
38	$GFA_{PJ,i,y}$	m^2	Total GFA of project buildings (premises) in buildings (premises) category i in year y	The following data sources may be used: 1. building plan (this is the preferred source); 2. on-site measurement (if 1. is not available)	-	For the first year of the project implementation, and every third year thereafter, or more frequently	1. confirm on-site that building geometry represented in the plan is accurate; 2. not applicable	-
40	$n_{PJ,i,y}$	-	Total number of project buildings (premises) included in the sample for buildings (premises) category iin year y	Project documentation (PDD)	-	Annually	-	The value of this parameter should always be larger than the minimum sample size
41	$N_{PJ,UNO,i,y}$ or $n_{PJ,UNO,i,y}$	-	Total number of project buildings (premises) not satisfying the occupancy criterion in the population ($N_{PJ,UNO,i,y}$) or sample ($n_{PJ,UNO,i,y}$) for buildings (premises) category iin year y.	Building survey	-	For the first year of the project implementation, and every third year thereafter, or more frequently	-	The occupancy criterion is as follows: 1 Buildings and premises for permanent residence of citizens, are occupied, and used as a primary, year-round residence; 2. Buildings and constructions of

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
								any number of floors for facilities serving the population, public society and the state, multifunctional public buildings (premises) are operated on annual average at least 30 hours/week
42	$GFA_{PJ,i,j,y}$ or $GFA_{PJ\text{-}Bldg,i,j,y}$	m^2	1. GFA of project buildings (premises) j in buildings (premises) category i in year y; or 2. GFA of the whole building, which project buildings (premises) j in buildings (premises)category i belongs to, in year y. Account for GFA of each buildings (premises) in the building, but not GFA of the common service areas	The following data sources may be used: 1. building plan (this is the preferred source); 2. on-site measurement (if 1. is not available)	-	For the first year of the project implementation, and every third year thereafter, or more frequently	1. confirm on-site that building geometry represented in the plan is accurate; 2. not applicable	$GFA_{PJ\text{-}Bldg,i,j,y}$ is applicable only if apportioning of project energy consumption and/or project emissions from the use of a refrigerant(s) is required
43	$PE_{EC,non\text{-}REcaptive,i,j,y}$	t CO_2/yr	Project emissions from electricity consumption of project buildings (premises) j in buildings (premises) category i in year y, which is supplied by an off-grid renewable captive power plant(s)	Project documentation (PDD)	-	annually	-	-
44	$PE_{FC,i,j,y}$	t CO_2/yr	Project emissions from fossil fuel consumption of project buildings	Project documentation (PDD	-	annually	-	-

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
			(premises) j in buildings (premises) category i in year y					
45	$WC_{PJ,i,j,y}$ or $WC_{PJ\text{-}Bldg,i,j,y}$	GJ/yr	Energy content of annual heat, chilled/hot water consumption in project buildings (premises) j in buildings (premises) category i in year y; or Energy content of annual heat, chilled/hot water consumption in the whole building, which baseline buildings (premises) j in buildings (premises) category i belongs to, in year y	Choose among the following options: 1. utility billing records; 2. on-site measurements	1. as per the utility metering; 2. use heat meters	1. as per the utility metering; 2. continuously, aggregated at least annually	Check consistency of the monitored records with the records from previous monitoring intervals	Applicable only if a heat meter is installed for monitoring of heat, chilled/hot water consumption. $WC_{PJ\text{-}Bldg,i,j,y}$ is applicable only if the fuel consumption is monitored only at a whole building level
46	$\eta_{PJ,dist,l,y}$	GJ of technical thermal energy losses in the heating, chilled/hot water systems distribution networks divided by GJ of thermal energy supplied to the buildings (premises)	Average technical distribution losses of heating, chilled/hot water systems l in year y	Monitoring records of thermal energy supply and demand or thermal energy loss measurement	1. based on monitoring of thermal energy supply and demand; or 2. measurement and estimation of surface thermal energy losses. Follow authentic engineering handbooks/ publications or national or international standards for calculation of the surface thermal energy losses	For the first year of the project implementation, and every third year thereafter	-	-
47	$m_{PJ,i,j,y}$	kg/yr	Annual chilled/hot water consumption (in mass) of project buildings (premises) j in buildings (premises) category i in year y	Choose among the following options: 1. utility billing records; 2. on-site measurements	1. as per the utility metering; 2. use mass meters	1. as per the utility metering; 2. continuously, aggregated at least annually	Check consistency of the monitored records with the records from previous monitoring intervals	Applicable only if a mass flow meter is installed for monitoring of chilled/hot water consumption
48	$v_{PJ,i,j,y}$	m^3/yr	Annual chilled/hot water consumption (in volume) of project buildings (premises) j in	Choose among the following options: 1. utility billing records;	1. as per the utility metering; 2. use mass meters	1. as per the utility metering;	Check consistency of the monitored records with the records from	Applicable only if a volume flow meter is installed for monitoring of

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
			buildings (premises) category i in year y	2. on-site measurements		2. continuously, aggregated at least annually	previous monitoring intervals	chilled/hot water consumption
49	$WP_{PJ,l,y}$	GJ/yr	Energy content of annual chilled/hot water production of heating, chilled/hot water system(s) l in year y	On-site measurements	Use heat meters	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a heat meter is installed for monitoring of chilled/hot water production
50	$m_{PJ,l,y}$	kg/yr	Annual chilled/hot water production (in mass) of heating, chilled/hot water system(s) l in year y	On-site measurements	Use mass meters	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a mass flow meter is installed for monitoring of chilled/hot water production
51	$\Delta t_{PJ,l,y}$	°C	Average temperature difference between the outlet and inlet of the heat exchanger used for the heat, chilled/hot water production in heating, chilled/hot water systems l in year y	The following data sources may be used: 1. readings taken from temperature meters installed at pipelines of inlet and outlet of the heat exchangers used for the heat, chilled/hot water supply (this is the preferred source); 2. specification of the manufacturer of the heating, chilled/hot water systems (If 1. is not available)	1. readings taken from temperature meters installed at pipeline of inlet and outlet of the heat exchanger; 2. not applicable	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a mass or volume flow meter is installed for monitoring of heat, chilled/hot water consumption. The temperature meter readings should be installed at the immediate inlet and outlet point of the heat exchanger of the heating, chilled/hot water systems
52	$\Delta t_{PJ,i,j,y}$	°C	Average temperature difference between the outlet and inlet of the heat exchangers used for the cooling and heating of buildings (premises) j in buildings (premises) category i in year y	Readings taken from temperature meters installed at pipelines of inlet and outlet of the heat exchangers used for the cooling and heating of buildings (premises) j	Readings taken from temperature meters installed at pipelines of inlet and outlet of the heat exchangers	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a mass or volume flow meters are installed for monitoring of heat, chilled/hot water consumption. The temperature meters readings

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
								should be installed at the immediate inlet and outlet points of the heat exchangers
53	$V_{PJ,l,y}$	m^3/yr	Annual heat, chilled/hot water production (in volume) of heating, chilled/hot water systems l in year y	On-site measurements	Use volume meters	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a volume flow meter is installed for monitoring of heat, chilled/hot water consumption
54	$PE_{WP,EC,l,y}$	t CO_2/yr	Project emissions from electricity consumption of heating, chilled/hot water systems l in year y	Project documentation (PDD)	-	For the first year of the project implementation, and every third year thereafter	-	-
55	$PE_{WP,FC,l,y}$	t CO_2/yr	Project emissions from fossil fuel consumption of heating, chilled/hot water systems l in year y	Project documentation (PDD)	-	For the first year of the project implementation, and every third year thereafter	-	-
56	$Q_{PJ,ref,l,y}$	t refrigerant/yr	Average annual quantity of the refrigerant used to replace the refrigerant that has leaked in chilled water system l in year y	Choose among the following options: 1. inventory data of refrigerant cylinders consumed in the heating, chilled/hot water system(s); 2. assume the high-end default value from Chapter 7: Emissions of fluorinated substitutes for Ozone depleting substances, Volume 3, Industrial Processes and Product Use, 2006 IPCC Guidelines for National Greenhouse Gas Inventories	-	For the first year of the project implementation, and every third year thereafter	Cross-check the quantities of refrigerants consumed with typical leakage rates of the refrigerants for the relevant application	-

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
57	$Q_{PJ,ref,l,Start,y}$	t refrigerant/yr	Quantity of the initial charge of the refrigerant in chilled water system l in year y	Manufacturer's data	-	Monitored only in the year in which the chilled water system started its operation	-	This emission source is accounted for only in the year in which the chilled water system started its operation
58	$Q_{PJ,ref,l,End,y}$	t refrigerant/yr	Quantity of the refrigerant in chilled water cooling system l that is recovered and destroyed or re-used in year y	Values provided by an entity responsible for the refrigerant destruction or re-use	As per a method approved under regulations of national legislation	Monitored only in the year in which the refrigerant is destroyed or re-used	Cross-check the quantities of refrigerants destroyed or re-used with typical initial charge and leakage rates of the refrigerants for the relevant application	This emission source is accounted only in the year in which the refrigerant is destroyed or re-used. If the destruction or re-use takes place after the end of a crediting period(s) of the project activity, this emission source should not be accounted nor is it mandatory to monitor this parameter
59	$GWP_{PJ,ref,l,y}$	t CO_2e/t refrigerant	Global Warming Potential of the refrigerant used in chilled water system l in year y	values listed in the IPCC's fourth assessment report shall be used	-	For the first year of the project implementation, and every third year thereafter	-	-
60	$w_{PJ,steam,CO2,l,y}$	t CO_2/t steam	Average mass fractions of CO_2 in the produced geothermal steam for the use in heating, chilled/hot water systems l in year y	On-site measurements	Non-condensable gases sampling should be carried out in production wells and at the steam field-power	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a geothermal source(s) supplies heat to the heating, chilled/hot water systems
61	$w_{PJ,steam,CH4,l,y}$	t CO_2/t steam	Average mass fractions of methane in the produced geothermal	On-site measurements	As per the procedures outlined for $w_{PJ,steam,CO2,l,y}$	For the first year of the project implementation,	-	Applicable only if a geothermal source(s) supplies

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
			steam for the use in heating, chilled/hot water systems l in year y			and every third year thereafter		heat to the heating, chilled/hot water systems
62	$M_{PJ,steam,l,y}$	t/yr	Quantity of geothermal gas produced for the use in heating, chilled/hot water systems l in year y	On-site measurements	The geothermal steam quantity discharged from the geothermal wells should be measured with a venturi flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venturi meter is required to define the steam properties. The calculation of geothermal steam quantities should be conducted on a continuous basis and should be based on national and international standards. The measurement results should be summarized transparently in regular production reports	For the first year of the project implementation, and every third year thereafter	-	Applicable only if a geothermal source(s) supplies heat to the heating, chilled/hot water systems
63	$Q_{PJ,ref,i,j,m,y}$ or $Q_{PJ\text{-}Bldg,ref,i,j,m,y}$	t refrigerant/yr	1. annual quantity of refrigerant type m used to replace the refrigerant(s) that has leaked in buildings (premises)j in buildings (premises)category i in year y, excluding refrigerant leakage from chilled water system; or 2. annual quantity of refrigerant type m used to replace the refrigerant(s) that has leaked in the whole building, which project buildings (premises) j in buildings (premises) category i belongs to, in year y, excluding	Choose among the following options: 1. inventory data of refrigerant cylinders consumed in the chilled water cooling system; 2. assume the high-end default value from Chapter 7: Emissions of fluorinated substitutes for Ozone depleting substances, Volume 3, Industrial Processes and Product Use, 2006 IPCC Guidelines for National Greenhouse Gas Inventories	-	Annually. Alternatively, only for the first three years of the corresponding crediting period, if the maximum annual value of the three-year monitoring period is to be used for the subsequent years in the crediting period	Cross-check the quantities of refrigerants consumed with typical leakage rates of the refrigerants for the relevant application	$Q_{PJ\text{-}Bldg,ref,i,j,m,y}$ is applicable only if the refrigerant leakage is monitored only at a whole building level

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
			refrigerant leakage from chilled water system					
64	$Q_{PJ,ref,i,j,m,Start,y}$ or $Q_{PJ-Bldg,ref,i,j,m,Start,y}$	t refrigerant/yr	1. quantity of the initial charge of refrigerant type m in a cooling device(s) used in project buildings (premises) j in buildings (premises) category i in year y, excluding refrigerant leakage from chilled water system; or 2. quantity of the initial charge of refrigerant type m in a cooling device(s) used in the whole building, which project buildings (premises) j in buildings (premises) category i belongs to, in year y, excluding refrigerant leakage from chilled water system	Manufacturer's data	-	Monitored only in the year in which the cooling device(s) started its operation	-	This emission source is accounted only in the year in which the cooling device(s) started its operation. $Q_{PJ-Bldg,ref,i,j,m,Start,y}$ is applicable only if the initial charge of the refrigerant consumption is monitored only at a whole building level
65	$Q_{PJ,ref,i,j,m,End,y}$ or $Q_{PJ-Bldg,ref,i,j,m,End,y}$	t refrigerant/yr	1. quantity of refrigerant type m in a cooling device(s) used in project buildings (premises) j in buildings (premises) category i that is recovered and destroyed or re-used in year y, excluding refrigerant leakage from chilled water system; or 2. quantity of refrigerant type m in a cooling device(s) used in the whole building, which project buildings (premises) j in buildings	Values provided by an entity responsible for the refrigerant destruction or re-use	In accordance with industry and national regulations	Monitored only in the year in which the refrigerant is destroyed or re-used	Cross-check the quantities of refrigerants destroyed or re-used with typical initial charge and leakage rates of the refrigerants for the relevant application	This emission source is accounted only in the year in which the refrigerant is destroyed or re-used. If the destruction or re-use takes place after the end of a crediting period(s) of the project activity, this emission source should not be accounted nor is it mandatory to

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
			(premises) category i belongs to, that is recovered and destroyed or re-used in year y, excluding refrigerant leakage from chilled water system					monitor this parameter. $Q_{PJ-Bldg,ref,i,j,m,End,y}$ is applicable only if the refrigerant destruction or re-use is monitored only at a whole building level
66	$GWP_{PJ,ref,i,j,m,y}$	t CO_2e/t refrigerant	Global Warming Potential of refrigerant type m used in project buildings (premises) j in buildings (premises) category i in year y	values listed in the IPCC's fourth assessment report shall be used	-	As per the monitoring frequency of $Q_{PJ,ref,i,j,m,y}$ or $Q_{PJ-Bldg,ref,i,j,m,y}$	-	-
67	$N_{PJ,i,y}$	-	Total number of project buildings (premises) in the population for buildings (premises) category i in year y	Project developer	-	Annually	-	-
68	$EC_{PJ,i,j,y}$ or $EC_{PJ-Bldg,i,j,y}$	MWh/yr	Quantity of electricity consumed by the project electricity consumption source j in year y Net increase in electricity consumption of source l in year y as a result of leakage	Direct measurement or calculated based on measurements from more than one electricity meters	Use electricity meters installed at the electricity consumption sources	Continuous measurement and at least monthly recording	In cases where electricity meters are regulated: the electricity meter will be subject to regular maintenance and testing in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements. In cases where electricity meters are not regulated: the electricity meter will be subject to regular maintenance and testing in accordance	-

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
							with the stipulation of the meter supplier or national requirements.	
69	$FC_{PJ,i,j,k,y}$ or $FC_{PJ-Bldg,i,j,y}$	Mass or volume unit/yr (e.g. tonne/yr or m^3/yr)	1. Annual consumption of fossil fuel type k of project buildings (premises) j in buildings (premises) category i in year y; or 2. Annualconsumption of fossil fuel type k of the whole building, which project buildings (premises) j in buildings (premises) category i belongs to, in year y. In both cases, the amount of fuel used for the electricity generation by the captive power plant(s) in the building that project buildings (premises) j belongs to shall not be included in the parameter	Onsite measurements	Use either mass or volume meters. The ruler gauge must be calibrated at least once a year and have a book of control for recording the measurements	Continuously	Check consistency of the monitored records with the records from previous monitoring intervals..	$FC_{PJ-Bldg,i,j,y}$ is applicable only if the fuel consumption is monitored only at a whole building level
70	$FF_{PJ,k,i,j,y}$	m^3/yr	Consumption of fossil fuel k in project buildings (premises) j in buildings (premises) category iin year y	Onsite measurements	Use either mass or volume meters. The ruler gauge must be calibrated at least once a year and have a book of control for recording the measurements	Continuously	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the project, the	Applicable only if the project activity is implemented under a programme of activities

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
							metered fuel consumption quantities should also be crosschecked with available purchase invoices from the financial records	
71	$NCV_{k,y}$	GJ/m^3	Average net calorific value of the fossil fuel kconsumed in year y	1. values provided by the fuel supplier in invoices (this is the preferred source); 2. measurements by the project participants (if 1. is not available); 3. regional or national default values (if 1. is not available); 4. IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories (if 1. is not available)	Measurements should be undertaken in line with national or international fuel standards	1. and 2.: the NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated. 3.: annually; 4. any future revision of the IPCC Guidelines should be taken into account	Verify if the values under 1., 2. and 3. are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines	Applicable only if the project activity is implemented under a programme of activities. Note that for the NCV the same basis (pressure and temperature) should be used as for the fuel consumption
72	$FF_{Top20\%,i,j,k,y}$	volume or mass unit/yr	Consumption of fossil fuel type k in top 20 per cent performer buildings (premises)j in buildings (premises) category i in year y	1. values provided by the fuel supplier in invoices (this is the preferred source); 2. measurements by the project participants (if 1. is not available); 3. regional or national default values (if 1. is not available); 4.	Measurements should be undertaken in line with national or international fuel standards	1. and 2.: the NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated. 3.: annually; 4. any future revision of the IPCC	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel	Applicable only if the project activity is implemented under a programme of activities

№	Data / Parameter	Data unit	Description	Source of data	Measurement procedures	Monitoring frequency	QA/QC procedures	Any comment
				IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories (if 1. is not available)		Guidelines should be taken into account	invoices can be identified specifically for the project, the metered fuel consumption quantities should also be crosschecked with available purchase invoices from the financial records	

Appendix 6. Project emissions and emission reductions for new and/or for existing buildings

Steps to calculate project emissions are described in Figure 2 (section 7).

In Russian regulatory documents, other units of measurement may be used in comparison to the calculation formulas proposed by the methodology. In such cases, the project developer needs to perform the recalculation.

A6.1. Step 1. Identification of buildings (premises) categories

The same buildings (premises) categories as defined in Step 1 are used (see Section A3.1.1 Appendix 3 and Section 3.3 Figure 1).

The definitions shall be clearly presented in the PDD, and remain the same for the entire crediting period(s) unless a request for approval of changes is made in accordance with applicable requirements under changes to registered project activity or programme of activities in the project cycle procedure.

A6.2. Step 2. Identification of project buildings (premises)

Project buildings (premises) shall be identified for each buildings (premises) category i defined in Step 1 (Section A6.1.). The project buildings (premises) shall consist of buildings (premises) in buildings (premises) category i, which satisfy the following occupancy criterion:

- that are occupied, and used as a primary, year-round residence (applicable only to residential buildings (premises), either in a low-rise or high-rise building);

- that are operated on annual average at least 30 hours/week (applicable only to categories B.-D. Appendix 1, either in a low-rise or high-rise building)[76].

The compliance with the occupancy criterion needs to be monitored ex post, and project buildings (premises) failing to satisfy the occupancy criterion shall be excluded from the pool of project buildings (premises) ($N_{PJ,UNO,i,y}$ or $n_{PJ,UNO,i,y}$, whether the population or sample is monitored). If all the buildings (premises) in the project boundary are monitored as project buildings (premises), the ex post monitoring assures that the non-compliant project buildings (premises) are not considered in the emission reduction calculation. If a sample of buildings (premises) in the project boundary is monitored as project buildings (premises), excluding the non-compliant project buildings (premises) does not ensure that there is no non-compliant project buildings (premises) in the population. Thus, the project and baseline emissions need to be corrected for the share of non-compliant project buildings (premises). For this purpose, the number of project buildings (premises) not satisfying the occupancy criterion ($n_{PJ,UNO,i,y}$) is monitored ex post.

The project developer may either choose to identify the project buildings (premises) as all the buildings (premises) in the project boundary or use a randomly selected sample of the buildings (premises) in the project boundary.

If the random sampling approach is used, emission reductions can be claimed only if the sample size is larger than the minimum sample size as determined below ($n_{PJ,min,i,y}$). This minimum number refers to the number of project buildings (premises), for which useful monitoring data are available in a particular monitoring interval. Therefore, to compensate for any possible dropouts from the sample group during the monitoring period, it will be necessary to initially

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[76] A buildings (premises) is considered to be in operation for the amount of hours the buildings (premises) is utilized for its main purpose (e.g. office work for an office buildings (premises)). The buildings (premises) might as well consume energy in other hours (e.g. standby energy consumption in the buildings (premises) during night time). However, those hours are not counted towards the operating hours.

select a sample size. Project developer may choose any size larger than the minimum sample size, taking into account the risk of dropouts from the sample group, the overhead costs for monitoring and the effect from reduced statistical errors on account of a larger sample size in calculating emission reductions. The minimum sample size needs to be updated every year because the total number of project buildings (premises) for buildings (premises) category i may change over time. Different sample sizes may be chosen for each vintage year as long as the sample sizes are larger than the minimum size.

$$n_{PJ,min,i,y} = \frac{{cv_{SE,Pj,i,y}}^2 \times {t_{0.05}}^2 \times N_{PJ,i,y}}{{P_{10\%}}^2 \times N_{PJ,i,y} + {cv_{SE,PJ,i,y}}^2 \times {t_{0.05}}^2} \qquad \text{(A6.1)}$$

Where:

$n_{PJ,min,i,y}$	Minimum sample size of project buildings (premises) in buildings (premises) category *i* in year *y.* Round up to the next integer if it is decimal
$cv_{SE,Pj,i,y}$	Coefficient of variation of specific emissions of project buildings (premises) in buildings (premises) category *i* in year *y*
$t_{0.05}$	t-value for a 90 % statistical significance level (1,645)
$P_{10\%}$	10 % precision requirement for a sample estimate (0,10)
$N_{PJ,i,y}$	Total number of project buildings (premises) for buildings (premises) category *i* in year *y*

$$cv_{SE,PJ,i,y} = \frac{\sigma_{POP,SE,PJ,i,y}}{\mu_{POP,SE,PJ,i,y}} \qquad \text{(A6.2)}$$

Where:

$cv_{SE,PJ,i,y}$	Coefficient of variation of specific emissions of project buildings (premises) in buildings (premises)category *i* in year *y*
$\sigma_{POP,SE,PJ,i,y}$	Expected population standard deviation of specific emissions of project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2/m^2)
$\mu_{POP,SE,PJ,i,y}$	Expected population mean of specific emissions of project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2/m^2)

$cv_{PJ,SE,i,y}$ is a measure of the expected variation in specific emissions of the population of project buildings (premises) in buildings (premises) category i in year y. For the first year, $cv_{SE,PJ,i,y}$ can be derived from officially published documents or own non-representative survey, accounting for the same emission sources as ones for the emission reduction calculation of the project activity. However, as necessary there may not be information readily available, a default factor of 0.5 is allowed to be used for the first year. For the second year, $cv_{SE,PJ,i,y}$ needs to be calculated based on the expected population mean and standard deviation of specific emissions of project buildings (premises) in buildings (premises) category i in year y ($\mu_{POP,SE,PJ,i,y}$ and $\sigma_{POP,SE,PJ,i,y}$). The sample mean and standard deviation of the same for the first year ($\mu_{SE,PJ,i,1}$ and $\sigma_{SE,PJ,i,1}$), calculated with the equations (A6.18) and (A6.19), may be used as proxies for $\mu_{POP,SE,PJ,i,y}$ and $\sigma_{POP,SE,PJ,i,y}$[77]. In case all the buildings (premises) in the project boundary are monitored as project buildings (premises), replace $n_{PJ,i,y}$ by $N_{PJ,i,y}$ in using the equations (A6.18) and (A6.19).

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[77] Regardless of additionality or existence of the fuel switching measures, these equations may be used for the sample size determination purpose

For the project buildings (premises) in buildings (premises) category i, the project emissions have to be calculated separately for each buildings (premises) category i for each crediting period year. If the random sampling approach is pursued, the same procedures as the baseline buildings (premises) sampling shall be followed.

The collection of the energy consumption data from the project buildings (premises) may require apportionment of the energy consumption if it is monitored only at a whole building level[78]. In this case, apportion the energy consumption by the GFA that each tenant/owner in the building occupies. Also, the use of a refrigerant(s) monitored only at a whole building level[79] shall also be apportioned by the GFA of the buildings (premises). Such apportionment can be mathematically expressed as follows:

$$X_{PJ,i,j,y} = X_{PJ-Bldg,i,j,y} \times \frac{GFA_{PJ,i,j,y}}{GFA_{PJ-Bldg,i,j,y}} \qquad \text{(A6.3)}$$

Where:

$X_{PJ,i,j,y}$	Project energy consumption (electricity, fossil fuel, or chilled water) or project emissions related to use of a refrigerant(s) in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (MWh, mass or volume unit, GJ, or t refrigerant/yr)
$X_{PJ-Bldg,i,j,y}$	Project energy consumption (electricity, fossil fuel, or chilled water) or project emissions related to the use of a refrigerant(s) in the whole building, which project buildings (premises) *j* in buildings (premises) category *i* belongs to, in year *y* (MWh, mass or volume unit, GJ, or t refrigerant/yr)
$GFA_{PJ,i,j,y}$	*GFA* of project buildings (premises) *j* in buildings (premises)category *i* in year *y* (m^2)
$GFA_{PJ-Bldg,i,j,y}$	*GFA* of the whole building, which project buildings (premises) *j* in buildings (premises) category *i* belongs to, in year *y*. Account for *GFA* of each premises in the building, but not *GFA* of the common service areas outside the physical boundaries of the premises (m^2)

A6.3. Step 3. Calculation of emissions of each project buildings (premises).

Calculate the annual emissions of each project buildings (premises) j in buildings (premises) category i identified in Step 2.

$$PE_{i,j,y} = PE_{EC,i,j,y} + PE_{FC,i,j,y} + PE_{WC,i,j,y} + PE_{ref,i,j,y} \qquad \text{(A6.4)}$$

Where:

$PE_{i,j,y}$	Project emissions of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/yr)
$PE_{EC,i,j,y}$	Project emissions from electricity consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)
$PE_{FC,i,j,y}$	Project emissions from fossil fuel consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)

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[78] For example, energy consumption for the operation of a central air conditioning system for a whole building may be metered only at a whole building level.
[79] For example the refrigerant use in a central air conditioner supplying the entire building

$PE_{WC,i,j,y}$	Project emissions from chilled/hot water consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)
$PE_{ref,i,j,y}$	Project emissions from the use of a refrigerant(s) in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/yr)

If it is justified that the project activity does not result in an increase of emissions from the use of a refrigerant(s) in buildings (premises) as compared to the baseline, $PE_{ref,i,j,y}$ may be excluded.

Calculation of project emissions from electricity consumption ($PE_{EC,i,j,y}$)

The project emissions from electricity consumption of project buildings (premises) j in buildings (premises) category i ($PE_{EC,i,j,y}$) are divided into the following two components:

$$PE_{EC,i,j,y} = PE_{EC,non-REcaptive,i,j,y} + PE_{EC,REcaptive,i,j,y} \quad \text{(A6.5)}$$

Where:

$PE_{EC,i,j,y}$	Project emissions from electricity consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)
$PE_{EC,non-REcaptive,i,j,y}$	Project emissions from electricity consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y*, which are supplied by the grid and/or an off-grid fossil-fuel-fired captive power plants (t CO_2/yr)
$PE_{EC,REcaptive,i,j,y}$	Project emissions from electricity consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y*, which are supplied by an off-grid renewable captive power plants (t CO_2/yr)

Project emissions from electricity consumption by project buildings (premises) may be calculated differently according to the sources of electricity generation (from the grid, from an local / off-grid captive power plant, from the grid and fossil fuel fired local / captive power plant)[80].

$PE_{EC,REcaptive,i,j,y}$ equals 0 (t CO_2/yr), the methodology excludes the use of biogas or biomass systems.

Calculation of project emissions from fuel consumption ($PE_{FC,i,j,y}$)

The calculation of the CO_2 emission factor from the combustion of fossil fuels (for the project as well as for the leakage emissions) should be based on one of the following two Options, depending on the availability of data on the fossil fuel type[81]:

1. Based on the chemical composition of the fossil fuel type (using the weighted average mass fraction of carbon of the fuel and the weighted average density of the fuel);

2. Based on net calorific value and CO_2 emission factor of the fuel type (using the weighted average net calorific value of the fuel and the weighted average CO_2 emission factor of the fuel).

Option 1 should be the preferred approach, if the necessary data is available.

Calculation of project emissions from chilled/hot water consumption ($PE_{WC,i,j,y}$)

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[80] The recommended approach to determine the network emission factor is defined in Appendix 9. The recommended approach to determine the indirect energy emissions factor for captive use and mini-grid is defined in Appendix 10.

[81] The calculation is similar to the algorithm in Section A3.1.3 of Appendix 3

The heating, chilled/hot water systems installed in project buildings (premises) applicable under this methodology should have configuration as depicted in Figure A3.1 (Section A3.1.3 of Appendix 3). The equations are derived considering this configuration in account.

The project emissions from heat, chilled/hot water consumption of project buildings (premises) j in buildings (premises) category i in year y ($PE_{WC,i,j,y}$) shall be calculated as follows:

$$PE_{WC,i,j,y} = \frac{WC_{PJ,i,j,y} \times EF_{PJ,WP,i,j,y}}{1 - \eta_{PJ,dist,l,y}} \quad \text{(A6.6)}$$

Where:

$PE_{WC,i,j,y}$	Project emissions from heat, chilled/hot water consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)
$WC_{PJ,i,j,y}$	Energy content of annual heat, chilled/hot water consumed in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/yr)
$EF_{PJ,WP,i,j,y}$	Emission factor for production of heat, chilled/hot water that is supplied to project unit *j* in buildings (premises) category *i* in year *y* (t CO_2/GJ)
$\eta_{PJ,dist,l,y}$	Average technical distribution losses of the heating, chilled/hot water systems *l* in year *y* (GJ of thermal energy losses in the heat, chilled/hot water distribution networks divided by GJ of thermal energy supplied to the buildings (premises))

If a heat meter) are installed for monitoring of the energy content of heat, chilled/hot water consumed in the project buildings (premises) j (may be centrally to the whole building), $WC_{PJ,i,j,y}$ can be derived directly from the meter reading. If only a mass or volume flow meter(s) and temperature indicators are installed, $WC_{PJ,i,j,y}$ is calculated according to the following equations:

$$WC_{PJ,i,j,y} = m_{PJ,i,j,y} \times \Delta t_{PJ,i,j,y} \times C_m \quad \text{(A6.7)}$$

Where:

$WC_{PJ,i,j,y}$	Energy content of annual heat, chilled/hot water consumption in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/yr)
$m_{PJ,i,j,y}$	Annual heat, chilled/hot water consumption (in mass) of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (kg/yr)
$\Delta t_{PJ,i,j,y}$	Average temperature difference between the outlet and inlet of the heat exchanger used for the cooling and heating of buildings (premises) *j* in buildings (premises) category *i* in year *y* (ºC)
C_m	Specific heat capacity of chilled/hot water (GJ/(kg· ºC))

In case the volumetric flow meter, and not mass flow meter, is installed, $m_{PJ,i,j,y}$ is calculated using the following equation:

$$m_{PJ,i,j,y} = v_{PJ,i,j,y} \times \rho_{H20} \quad \text{(A6.8)}$$

Where:

$m_{PJ,i,j,y}$	Annual heat, chilled/hot water consumption (in mass) of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (kg/yr)

$v_{PJ,i,j,y}$	Annual heat, chilled/hot water consumption (in volume) of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (m^3/yr)
ρ_{H20}	Density of the chilled/hot water (kg/m^3)

The emission factor for heat, chilled/hot water production ($EF_{PJ,WP,i,j,y}$) shall be calculated for each centralised heating, chilled/hot water system(s) I that supplies the chilled/hot water to the respective buildings (premises) j in buildings (premises) category i in year y, according to the following equation. If the supply of heat, chilled/hot water is claimed for carbon units in any other registered project, $EF_{PJ,WP,i,j,y}$ shall be equal to the baseline emission factor of the heat, chilled/hot water supply calculated according to the methodology applied to the registered project. Such treatment is necessary to avoid double counting of emission reductions.

$$EF_{PJ,WP,i,j,y} = \frac{PE_{WP,EC,l,y} + PE_{WP,FC,l,y} + PE_{WP,FE,l,y}}{WP_{PJ,l,y}} \quad \text{(A6.9)}$$

Where:

$EF_{PJ,WP,i,j,y}$	Emission factor for production of heat, chilled/hot water that is supplied to project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/GJ)
$PE_{WP,EC,l,y}$	Project emissions from electricity consumption of heating, chilled/hot water systems *l* in year *y* (t CO_2/yr)
$PE_{WP,FC,l,y}$	Project emissions from fuel consumption of heating, chilled/hot water systems *l* in year *y* (t CO_2/yr)
$PE_{WP,FE,l,y}$	Project fugitive emissions of CO_2 and methane due to release of non-condensable gases from geothermal sources in heat, chilled/hot water production in heating, chilled/hot water systems *l* in year *y* (t CO_2/yr)
$WP_{PJ,l,y}$	Energy content of annual heat, chilled/hot water production of heating, chilled/hot water systems *l* in year *y* (GJ/yr)

If a heat meters is installed for monitoring of the heat, chilled/hot water production in the heating, chilled/hot water systems l, $WP_{PJ,l,y}$ can be derived directly from the meter reading. If only a mass or volume flow meters is installed, $WP_{PJ,l,y}$ is calculated according to the following equations:

$$WP_{PJ,l,y} = m_{PJ,l,y} \times \Delta t_{PJ,l,y} \times C_m \quad \text{(A6.10)}$$

Where:

$WP_{PJ,l,y}$	Energy content of annual heat, chilled/hot water production of heating, chilled/hot water systems *l* in year *y* (GJ/yr)
$m_{PJ,l,y}$	Annual heat, chilled/hot water production (in mass) of heating, chilled/hot water systems *l* in year *y* (kg/yr)
$\Delta t_{PJ,l,y}$	Average temperature difference between the outlet and inlet of the heat exchanger used for the heat, chilled/hot water production in heating, chilled/hot water systems *l* in year *y* (ºC)
C_m	Specific heat capacity of the heat, chilled/hot water (GJ/(kg· ºC))

In case a volumetric flow meter, and not a mass flow meter, is installed, $m_{PJ,l,y}$ is calculated using the following equation:

$$m_{PJ,l,y} = v_{PJ,l,y} \times \rho_{H2O} \quad \text{(A6.11)}$$

Where:

$m_{PJ,l,y}$	Annual heat, chilled/hot water production (in mass) of chilled water system *l* in year *y* (kg/yr)
$v_{PJ,l,y}$	Annual heat, chilled/hot water production (in volume) of chilled water system *l* in year *y* (m^3/yr)
ρ_{H2O}	Density of the chilled/hot water(kg/m^3)

The electricity consumption includes the consumption all electrical equipment as a part of central heating, chilled/hot water systems for example compressor, pumps etc.

In case all or part of the heat consumed in heating, chilled/hot water systems I is supplied by a geothermal source, the fugitive emissions from these sources are calculated as follows:

$$PE_{WP,FE,l,y} = \left(w_{PJ,steam,CO2,l,y} + w_{PJ,steam,CH4,l,y} \times GWP_{CH4}\right) \times M_{PJ,steam,l,y} \quad \text{(A6.12)}$$

Where:

$PE_{WP,FE,l,y}$	Project fugitive emissions of CO_2 and CH_4 due to release of non-condensable gases from geothermal sources in heat, chilled/hot water production in heating, chilled/hot water systems *l* in year *y* (t CO_2/yr)
$w_{PJ,steam,CO2,l,y}$	Average mass fractions of CO_2 in the produced geothermal steam for the use in heating, chilled/hot water systems *l* in year *y* (t CO_2/t steam)
$w_{PJ,steam,CH4,l,y}$	Average mass fractions of CH_4 in the produced geothermal steam for the use in heating, chilled/hot water systems *l* in year *y* (t CH_4/t steam)
GWP_{CH4}	Global Warming Potential of methane valid for the relevant commitment period (t CO_2e/t CH_4)
$M_{PJ,steam,l,y}$	Quantity of geothermal steam produced for the use in heating, chilled/hot water systems *l* in year *y* (t/yr)

Calculation of project emissions from the use of a refrigerant(s) ($PE_{ref,i,j,y}$)

The project emissions from the use of a refrigerant(s) in project buildings (premises) j in buildings (premises) category i in year y ($PE_{ref,i,j,y}$) shall be calculated as follows:

$$PE_{ref,i,j,y} = \sum_{m}\left(Q_{PJ,ref,i,j,m,y} + Q_{PJ,ref,i,j,m,Start} - Q_{PJ,ref,i,j,m,End}\right) \times GWP_{PJ,ref,i,j,m,y} + PE_{WP,ref,l,y} \times \frac{WC_{PJ,i,j,y}}{\left(1 - \eta_{PJ,dist,l,y}\right) \times WP_{PJ,l,y}} \quad \text{(A6.13)}$$

Where:

$PE_{ref,i,j,y}$	Project emissions from the use of a refrigerant(s) in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/yr)
$Q_{PJ,ref,i,j,m,y}$	Annual quantity of refrigerant type *m* used to replace the refrigerant(s) that has leaked in project buildings (premises) *j* in buildings (premises)

	category *i* in year *y*, excluding refrigerant leakage from chilled water system (t refrigerant/yr)
$Q_{PJ,ref,i,j,m,Start}$	Quantity of the initial charge of refrigerant type *m* in chiller(s) used in project buildings (premises) *j* in buildings (premises) category *i* in year *y*, excluding refrigerant leakage from chilled water system (t refrigerant/yr)
$Q_{PJ,ref,i,j,m,End}$	Quantity of refrigerant type *m* in chiller(s) used in project buildings (premises) *j* in buildings (premises) category *i* that is recovered and destroyed or re-used in year *y*, excluding refrigerant leakage from chilled water system (t refrigerant/yr)
$GWP_{PJ,ref,i,j,m,y}$	Global Warming Potential of refrigerant type *m* used in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/t refrigerant)
$WC_{PJ,i,j,y}$	Energy content of annual chilled water consumption in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/yr)
$PE_{WP,ref,l,y}$	Project emissions from the use of a refrigerant in chilled water system *l* in year *y* (t CO_2/yr)
$\eta_{PJ,dist,l,y}$	Average technical distribution losses of the chilled/hot water systems *l* in year *y* (GJ of technical thermal energy losses in the chilled/hot water distribution networks divided by GJ of thermal energy supplied to the buildings (premises))
$WP_{PJ,l,y}$	Energy content of annual heat, chilled/hot water production of heating, chilled/hot water systems *l* in year *y* (GJ/yr)

The project emissions from the use of a refrigerant in chilled/hot water system(s) I in year y ($PE_{WP,ref,l,y}$) are calculated as follows:

$$PE_{WP,ref,l,y} = \left(Q_{PJ,ref,l,y} + Q_{PJ,ref,l,Start} - Q_{PJ,ref,l,End}\right) \times GWP_{PJ,ref,l,y} \quad \text{(A6.14)}$$

Where:

$PE_{WP,ref,l,y}$	Project emissions from the use of a refrigerant in chilled water system *l* in year *y* (t CO_2/yr)
$Q_{PJ,ref,l,y}$	Average annual quantity of the refrigerant used to replace the refrigerant that has leaked in chilled water system *l* in year *y* (t refrigerant/yr)
$Q_{PJ,ref,l,Start}$	Quantity of the initial charge of the refrigerant in chilled water system *l* in year *y* (t refrigerant/yr)
$Q_{PJ,ref,l,End}$	Quantity of the refrigerant in chilled water system *l* that is recovered and destroyed or re-used in year *y* (t refrigerant/yr)
$GWP_{PJ,ref,l,y}$	Global Warming Potential of the refrigerant used in chilled water system *l* in year *y* (t CO_2e/t refrigerant)

A6.4. Step 4a. Calculation of project emissions

Follow this step if fuel switching measures of the project activity are demonstrated additional or separate additionality demonstration of the fuel switching measures is not required

If all the buildings (premises) in the project boundary are monitored as project buildings (premises), the project emission shall be calculated as follows:

$$PE_y = \sum_i \sum_j PE_{i,j,y} \times DISC_{i,y} \quad \text{(A6.15)}$$

Where:

PE_y	Project emissions from project buildings (premises) in year *y* (t CO_2e/yr)
$PE_{i,j,y}$	Project emissions from project buildings (premises) *j* in buildings (premises) category *i* in year *y*(t CO_2e/yr)
$DISC_{i,y}$	Discount factor for double-counting of emissions reductions due to overlapping use of efficient appliances in buildings (premises) category *i* in year *y*. The discount factor is to be calculated using equation provided in the Appendix 3

If a sample of buildings (premises) in the project boundary is monitored as project buildings (premises), calculate the SE of project buildings (premises) j in buildings (premises) category i in year y, defined as emissions per GFA in square metre per year:

$$SE_{PJ,i,j,y} = \frac{PE_{i,j,y}}{GFA_{PJ,i,j,y}} \quad \text{(A6.16)}$$

Where:

$SE_{PJ,i,j,y}$	Specific emissions of project buildings (premises) *j* in buildings (premises) category *i* in year *y*, defined as emissions per *GFA* in square metre per year (t CO_2e/(m^2·yr))
$PE_{i,j,y}$	Project emissions of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/yr)
$GFA_{PJ,i,j,y}$	*GFA* of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (m^2)

Calculate the average SE of the project buildings (premises) in buildings (premises) category i in year y ($SE_{PJ,i,y}$), adjusting for the sample error as follows:

$$SE_{PJ,i,y} = \mu_{SE,PJ,i,y} + t_{0.05} \times \frac{\sigma_{SE,PJ,i,y}}{\sqrt{n_{PJ,i,y}}} \quad \text{(A6.17)}$$

Where:

$SE_{PJ,i,y}$	Mean of specific emissions of project buildings (premises) in buildings (premises) category *i* in year *y*, defined as emissions per *GFA* in square meter per year (t CO_2e/(m^2·yr))
$\mu_{SE,PJ,i,y}$	Sample mean of specific emissions of project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$t_{0.05}$	t-value for a 90 % statistical significance level (1,645)
$\sigma_{SE,PJ,i,y}$	Standard deviation of specific emissions of project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$n_{PJ,i,y}$	Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

$$\mu_{SE,PJ,i,y} = \frac{\sum_j SE_{PJ,i,j,y}}{n_{PJ,i,y}} \quad \text{(A6.18)}$$

Where:

$\mu_{SE,PJ,i,y}$	Sample mean of specific emissions of project buildings (premises) in buildings (premises)category *i* in year *y* (t CO_2e/(m^2·yr))
$SE_{PJ,i,j,y}$	Specific emissions of project buildings (premises) *j* in buildings (premises)t category *i* in year *y*, defined as emissions per *GFA* in square meter per year (t CO_2e/(m^2·yr))
$n_{PJ,i,y}$	Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

$$\sigma_{SE,PJ,i,y} = \sqrt{\frac{\sum_j \left(SE_{PJ,i,j,y} - \mu_{SE,PJ,i,y}\right)^2}{n_{PJ,i,y} - 1}} \quad \text{(A6.19)}$$

Where:

$\sigma_{SE,PJ,i,y}$	Standard deviation of specific emissions of project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$SE_{PJ,i,j,y}$	Specific emissions of project buildings (premises) *j* in buildings (premises) category *i* in year *y*, defined as emissions per *GFA* in square metre per year (t CO_2e/(m^2·yr))
$\mu_{SE,PJ,i,y}$	Sample mean of specific emissions of project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$n_{PJ,i,y}$	Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

Based on $SE_{PJ,i,y}$ determined above, the project emissions are calculated by multiplying $SE_{PJ,i,y}$ by the total GFA of the project buildings (premises) in the corresponding buildings (premises) category i. Accordingly, the total project emissions are calculated as follows:

$$PE_y = \sum_i SE_{PJ,i,y} \times GFA_{PJ,i,y} \times CF_{PJ,i,y} \times DISC_{i,y} \quad \text{(A6.20)}$$

Where:

PE_y	Project emissions of project buildings (premises) in year *y* (t CO_2e/yr)
$SE_{PJ,i,y}$	Mean of specific emissions of project buildings (premises) in buildings (premises) category *i* in year *y*, defined as emissions per *GFA* in square metre per year (t CO_2e/(m^2·yr))
$GFA_{PJ,i,y}$	Total GFA of project buildings (premises) in buildings (premises) category *i* in year *y* (m^2)
$CF_{PJ,i,y}$	Correction factor for occupancy of project buildings (premises) in buildings (premises) category *i* in year *y*
$DISC_{i,y}$	Discount factor for double-counting of emissions reductions due to overlapping use of efficient appliances in buildings (premises) category *i* in year *y*. The discount factor is to be calculated using equation provided in Appendix 3

The project correction factor for occupancy of project buildings (premises) ($CF_{PJ,i,y}$) is set to 1 (one) if all the buildings (premises) in the project boundary are monitored as project buildings (premises). If a sample of buildings (premises) in the project boundary is monitored as project buildings (premises), $CF_{PJ,i,y}$ shall be calculated as follows:

$$CF_{PJ,i,y} = 1 - \left(\lambda_{PJ,i,y} - t_{0.05} \times \sqrt{\frac{\lambda_{PJ,i,y} \times (1 - \lambda_{PJ,i,y})}{n_{PJ,i,y}}}\right) \quad \text{(A6.21)}$$

Where:

$CF_{PJ,i,y}$	Project correction factor for occupancy of project buildings (premises) in buildings (premises) category *i* in year *y*
$\lambda_{PJ,i,y}$	Share of buildings (premises) not meeting the occupancy criterion for project buildings (premises) in buildings (premises) category *i* in year *y*
$t_{0.05}$	t-value for a 90 % statistical significance level (1,645)
$n_{PJ,i,y}$	Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

$$\lambda_{PJ,i,y} = \frac{n_{PJ,UNO,i,y}}{n_{PJ,i,y}} \quad \text{(A6.22)}$$

Where:

$\lambda_{PJ,i,y}$	Share of buildings (premises) not meeting the occupancy criterion for project buildings (premises) in buildings (premises) category *i* in year *y*
$n_{PJ,UNO,i,y}$	Total number of project buildings (premises) not satisfying the occupancy criterion in the sample for buildings (premises)category *i* in year *y*. See Step 2 “Identification of project buildings (premises) for the occupancy criterion
$n_{PJ,i,y}$	Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

Follow this step if fuel switching measures of the project activity are not demonstrated additional or the project activity does not claim carbon units for emission reductions from the fuel switching measures

The project emissions shall be calculated as follows[82]:

$$PE_y = \sum_i \{(ECI_{PJ,i,y} \times CI_{Top20\%,EC,i,y} + FCI_{PJ,i,k,y} \times CI_{Top20\%,FC,i,y} + WCI_{PJ,i,y} \times CI_{Top20\%,WC,i,y} + REFI_{PJ,i,y}) \times GFA_{PJ,i,y} \times CF_{PJ,i,y} \times DISC_{i,y}\} \quad \text{(A6.23)}$$

Where:

PE_y	Project emissions from project buildings (premises) in year *y* (t CO_2e/yr)

[82] In this equation, the carbon intensity of energy sources is derived from the parameters used for the baseline emission calculation in order to exclude emission reductions from fuel switching measures

$ECI_{PJ,i,y}$	Average specific electricity consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (MWh/(m^2·yr))
$CI_{Top20\%,EC,i,y}$	Average carbon intensity of electricity used in the top 20 % performer baseline buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$FCI_{PJ,i,k,y}$	Average specific consumption of energy of fossil fuel type *k* of project buildings (premises) in buildings (premises)category *i* in year *y* (MWh/(m^2·yr))
$CI_{Top20\%,FC,i,y}$	Average carbon intensity of fossil fuel used in the top 20 % performer baseline buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$WCI_{PJ,i,y}$	Average specific heat, chilled/hot water consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (GJ/(m^2·yr))
$CI_{Top20\%,WC,i,y}$	Average carbon intensity of heat, chilled/hot water used in the top 20 % performer baseline buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/GJ)
$REFI_{PJ,i,y}$	Average specific emissions from the use of a refrigerant(s) in project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$GFA_{PJ,i,y}$	Total GFA of project buildings (premises) in buildings (premises) category *i* in year *y* (m^2)
$CF_{PJ,i,y}$	Project correction factor for occupancy of project buildings (premises) in buildings (premises) category *i* in year *y*, calculated applying the equations (A6.21) and (A6.22)
$DISC_{i,y}$	Discount factor for double-counting of emissions reductions due to overlapping use of efficient appliances in buildings (premises) category *i* in year *y*. The discount factor is to be calculated using equation provided in Appendix 3

Calculation of average carbon intensity of energy sources

Using the same set of top 20 % performer buildings (premises) identified in Sub-step "Selection of the top 20 % performer buildings (premises) (see Section A3.1.4 of Appendix 3), the average carbon intensity of different energy sources ($CI_{Top20\%,EC,i,y}$,$CI_{Top20\%,FC,i,y}$ and $CI_{Top20\%,WC,i,y}$) shall be calculated.

The average carbon intensity of electricity used in the top 20 % performer buildings (premises) ($CI_{Top20\%,EC,i,y}$) is calculated as follows:

$$CI_{Top20\%,EC,i,y} = \frac{\sum_j CI_{Top20\%,EC,i,j,y}}{J_{i,y}} \quad \text{(A6.24)}$$

Where:

$CI_{Top20\%,EC,i,y}$	Average carbon intensity of electricity used in the top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$CI_{Top20\%,EC,i,j,y}$	Carbon intensity of electricity used in top 20 % performer baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$J_{i,y}$	Total number of top 20 % performer baseline buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/yr). It is calculated as the

product of the number of baseline buildings (premises) monitored in building category *i* and 20 %, rounded down to the next integer if it is decimal

$CI_{Top20\%,EC,i,j,y}$ is the carbon intensity of electricity used in baseline buildings (premises)j in buildings (premises)t categoryi in year y ($CI_{BL,EC,i,j,y}$), which is calculated as follows:

$$CI_{BL,EC,i,j,y} = \frac{BE_{EC,i,j,y}}{EC_{BL,i,j,y}} \qquad \text{(A6.25)}$$

Where:

$CI_{BL,EC,i,j,y}$	Carbon intensity of electricity used in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$BE_{EC,i,j,y}$	Baseline emissions from electricity consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)
$EC_{BL,i,j,y}$	Electricity consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (MWh/yr)

The average carbon intensity of fuel used in the top 20 % performer buildings (premises) ($CI_{Top20\%,FC,i,y}$) is calculated as follows:

$$CI_{Top20\%,FC,i,y} = \frac{\sum_j CI_{Top20\%,FC,i,j,y}}{J_{i,y}} \qquad \text{(A6.26)}$$

Where:

$CI_{Top20\%,FC,i,y}$	Average carbon intensity of fuel used in the top 20 % performer baseline buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$CI_{Top20\%,FC,i,j,y}$	Carbon intensity of fuel used in top 20 % performer baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$J_{i,y}$	Total number of top 20 % performer baseline buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/yr). It is calculated as the product of the number of baseline buildings (premises) monitored in building category *i* and 20 %, rounded down to the next integer if it is decimal

$CI_{Top20\%,FC,i,j,y}$ is the carbon intensity of fuel used in baseline buildings (premises) j in buildings (premises) category i in year y ($CI_{BL,FC,i,j,y}$), which is calculated as follows:

$$CI_{BL,FC,i,j,y} = \frac{BE_{FC,i,j,y}}{FC_{BL,i,j,y}} \qquad \text{(A6.27)}$$

Where:

$CI_{BL,FC,i,j,y}$	Carbon intensity of fuel used in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/MWh)
$BE_{FC,i,j,y}$	Baseline emissions from fuel consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)
$FC_{BL,i,j,y}$	Fuel consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (MWh/yr)

The average carbon intensity of heat, chilled/hot water used in the top 20 % performer buildings (premises) ($CI_{Top20\%,WC,i,y}$) is calculated as follows:

$$CI_{Top20\%,WC,i,y} = \frac{\sum_j CI_{Top20\%,WC,i,j,y}}{J_{i,y}} \quad (A6.28)$$

Where:

$CI_{Top20\%,WC,i,y}$	Average carbon intensity of heat, chilled/hot water used in the top 20 % performer buildings (premises) in buildings (premises)category *i* in year *y* (t CO_2e/GJ)
$CI_{Top20\%,WC,i,j,y}$	Carbon intensity of heat, chilled/hot water used in top 20 % performer baseline buildings (premises) *j* in buildings (premises)category *i* in year *y* (t CO_2e/GJ)
$J_{i,y}$	Total number of top 20 % performer buildings (premises) in baseline buildings (premises) category *i* in year *y* (t CO_2e/yr). It is calculated as the product of the number of baseline buildings (premises) monitored in building category *i* and 20 %, rounded down to the next integer if it is decimal

$CI_{Top20\%,WC,i,j,y}$ is a subset of carbon intensity of heat, chilled/hot water used in baseline buildings (premises) j in buildings (premises) category i in year y ($CI_{BLWC,i,j,y}$), which is calculated as follows:

$$CI_{BL,WC,i,j,y} = \frac{BE_{WC,i,j,y}}{WC_{BL,i,j,y}} \quad (A6.29)$$

Where:

$CI_{BL,WC,i,j,y}$	Carbon intensity of heat, chilled/hot water used in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/GJ)
$BE_{WC,i,j,y}$	Baseline emissions from heat, chilled/hot water consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2/yr)
$WC_{BL,i,j,y}$	Energy content of annual heat, chilled/hot water consumption in baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/yr)

Calculation of average specific energy consumption and refrigerant leakage

If all the buildings (premises) in the project boundary are monitored as project buildings (premises), the average specific electricity consumption of the project buildings (premises) ($ECI_{PJ,i,y}$) is calculated as follows:

$$ECI_{PJ,i,y} = \frac{\sum_j ECI_{PJ,i,j,y}}{N_{PJ,i,y}} \quad (A6.30)$$

Where:

$ECI_{PJ,i,y}$	Average specific electricity consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (MWh/(m^2·yr))
$ECI_{PJ,i,j,y}$	Specific electricity consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (MWh/(m^2·yr))

$N_{PJ,i,y}$	Total number of project buildings (premises) in the population for buildings (premises) category *i* in year *y*

$$ECI_{PJ,i,j,y} = \frac{EC_{PJ,i,j,y}}{GFA_{PJ,i,j,y}} \quad \text{(A6.31)}$$

Where:

$ECI_{PJ,i,j,y}$	Specific electricity consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (MWh/(m^2·yr))
$EC_{PJ,i,j,y}$	Electricity consumption of baseline buildings (premises) *j* in buildings (premises) category *i* in year *y* (MWh/yr)
$GFA_{PJ,i,j,y}$	GFA of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (m^2)

If all the buildings (premises) in the project boundary are monitored as project buildings (premises), the average specific consumption fossil fuel type k of project buildings (premises) ($FCI_{PJ,i,k,y}$) is calculated as follows:

$$FCI_{PJ,i,k,y} = \frac{\sum_j FCI_{PJ,i,j,k,y}}{N_{PJ,i,y}} \quad \text{(A6.32)}$$

Where:

$FCI_{PJ,i,k,y}$	Average specific consumption of fossil fuel type *k* of project buildings (premises) in buildings (premises) category *i* in year *y* (mass or volume unit/(m^2·yr))
$FCI_{PJ,i,j,k,y}$	Specific consumption of fossil fuel type *k* of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (mass or volume unit/(m^2·yr))
$N_{PJ,i,y}$	Total number of project buildings (premises) in the population for buildings (premises) category *i* in year *y*

$$FCI_{PJ,i,j,k,y} = \frac{FC_{PJ,i,j,k,y}}{GFA_{PJ,i,j,y}} \quad \text{(A6.33)}$$

Where:

$FCI_{PJ,i,j,k,y}$	Specific consumption of fossil fuel type *k* of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (mass or volume unit/(m^2·yr))
$FC_{PJ,i,j,k,y}$	Annual consumption of fossil fuel type *k* of project buildings (premises) *j* in buildings (premises) category *i* in year *y*. The amount of fuel used for the electricity generation by the captive power plant(s) in the building that project buildings (premises)*j* belongs to shall not be included in the parameter (mass or volume unit/yr)
$GFA_{PJ,i,j,y}$	*GFA* of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (m^2)

If all the buildings (premises) in the project boundary are monitored as project buildings (premises), the average specific heat, chilled/hot water consumption of project buildings (premises) ($WCI_{PJ,i,y}$) is calculated as follows:

$$WCI_{PJ,i,y} = \frac{\sum_j WCI_{PJ,i,j,y}}{N_{PJ,i,y}} \tag{A6.34}$$

Where:

$WCI_{PJ,i,y}$	Average specific heat, chilled/hot water consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (GJ/(m^2·yr))
$WCI_{PJ,i,j,y}$	Specific heat, chilled/hot water consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/(m^2·yr))
$N_{PJ,i,y}$	Total number of project buildings (premises) in the population for buildings (premises) category *i* in year *y*

$$WCI_{PJ,i,j,y} = \frac{WC_{PJ,i,j,y}}{GFA_{PJ,i,j,y}} \tag{A6.35}$$

Where:

$WCI_{PJ,i,j,y}$	Specific heat, chilled/hot water consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/(m^2·yr))
$WC_{PJ,i,j,y}$	Energy content of annual heat, chilled/hot water consumption in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/yr)
$GFA_{PJ,i,j,y}$	GFA of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (m^2)

If all the buildings (premises) in the project boundary are monitored as project buildings (premises), the average specific emissions from the use of a refrigerant(s) in project buildings (premises) ($REFI_{PJ,i,y}$) is calculated as follows:

$$REFI_{PJ,i,y} = \frac{\sum_j REFI_{PJ,i,j,y}}{N_{PJ,i,y}} \tag{A6.36}$$

Where:

$REFI_{PJ,i,y}$	Average specific emissions from the use of a refrigerant(s) in project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$REFI_{PJ,i,j,y}$	Specific emissions from the use of a refrigerant(s) in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$N_{PJ,i,y}$	Total number of project buildings (premises) in the population for buildings (premises) category *i* in year *y*

$$REFI_{PJ,i,j,y} = \frac{PE_{ref,i,j,y}}{GFA_{PJ,i,j,y}} \tag{A6.37}$$

Where:

$REFI_{PJ,i,j,y}$	Specific emissions from the use of a refrigerant(s) in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$PE_{ref,i,j,y}$	Project emissions from the use of a refrigerant(s) in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/yr)

$GFA_{PJ,i,j,y}$ GFA of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (m^2)

If a sample of buildings (premises) in the project boundary is monitored as project buildings (premises), the calculated $ECI_{PJ,i,y}$, $FCI_{PJ,i,k,y}$, $WCI_{PJ,i,y}$ and $REFI_{PJ,i,y}$ shall be conservatively adjusted for the sampling error. Namely, the adjustment requires $ECI_{PJ,i,y}$, $FCI_{PJ,i,k,y}$, $WCI_{PJ,i,y}$ and $REFI_{PJ,i,y}$ to be the higher-bound value of the confidence interval established around the average EI and REFI of the project buildings (premises) at a 90 % significance level.

$$ECI_{PJ,i,y} = \mu_{ECI,PJ,i,y} + t_{0.05} \times \frac{\sigma_{ECI,PJ,i,y}}{\sqrt{n_{PJ,i,y}}} \quad \text{(A6.38)}$$

and

$$FCI_{PJ,i,k,y} = \mu_{FCI,PJ,i,k,y} + t_{0.05} \times \frac{\sigma_{FCI,PJ,i,k,y}}{\sqrt{n_{PJ,i,y}}} \quad \text{(A6.39)}$$

and

$$WCI_{PJ,i,y} = \mu_{WCI,PJ,i,y} + t_{0.05} \times \frac{\sigma_{WCI,PJ,i,y}}{\sqrt{n_{PJ,i,y}}} \quad \text{(A6.40)}$$

and

$$REFI_{PJ,i,y} = \mu_{REFI,PJ,i,y} + t_{0.05} \times \frac{\sigma_{REFI,PJ,i,y}}{\sqrt{n_{PJ,i,y}}} \quad \text{(A6.41)}$$

Where:

$ECI_{PJ,i,y}$	Average specific electricity consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (MWh/(m^2·yr))
$FCI_{PJ,i,k,y}$	Average specific consumption of fossil fuel type *k* of project buildings (premises) in buildings (premises) category *i* in year *y* (mass or volume unit/(m^2·yr))
$WCI_{PJ,i,y}$	Average specific heat, chilled/hot water consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (GJ/(m^2·yr))
$REFI_{PJ,i,y}$	Average specific emissions from the use of a refrigerant(s) in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))
$\mu_{ECI,PJ,i,y}$	Sample mean of specific electricity consumption of project buildings (premises) in buildings (premises) category *i*in year *y* (MWh/(m^2·yr))
$\mu_{FCI,PJ,i,k,y}$	Sample mean of specific consumption of fossil fuel type *k* of project buildings (premises) in buildings (premises) category *i* in year *y* (mass or volume unit/(m^2·yr))
$\mu_{WCI,PJ,i,y}$	Sample mean of specific heat, chilled/hot water consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (GJ/(m^2·yr))
$\mu_{REFI,PJ,i,y}$	Sample mean of specific emissions from the use of a refrigerant(s) in project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))

$t_{0.05}$ | t-value for a 90 % statistical significance level (1,645)

$\sigma_{ECI,PJ,i,y}$ | Standard deviation of specific electricity consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (MWh/(m^2·yr))

$\sigma_{FCI,PJ,i,k,y}$ | Standard deviation of specific consumption of fossil fuel type *k* of project buildings (premises) in buildings (premises) category *i* in year *y* (mass or volume unit/(m^2·yr))

$\sigma_{WCI,PJ,i,y}$ | Standard deviation of specific heat, chilled/hot water consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (GJ/(m^2·yr))

$\sigma_{REFI,PJ,i,y}$ | Standard deviation of specific emissions from the use of a refrigerant(s) in project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))

$n_{PJ,i,y}$ | Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

$$\mu_{ECI,PJ,i,y} = \frac{\sum_j ECI_{PJ,i,j,y}}{n_{PJ,i,y}} \quad \text{(A6.42)}$$

and

$$\mu_{FCI,PJ,i,k,y} = \frac{\sum_j FCI_{PJ,i,j,k,y}}{n_{PJ,i,y}} \quad \text{(A6.43)}$$

and

$$\mu_{WCI,PJ,i,y} = \frac{\sum_j WCI_{PJ,i,j,y}}{n_{PJ,i,y}} \quad \text{(A6.44)}$$

and

$$\mu_{REFI,PJ,i,y} = \frac{\sum_j REFI_{PJ,i,j,y}}{n_{PJ,i,y}} \quad \text{(A6.45)}$$

Where:

$\mu_{ECI,PJ,i,y}$ | Sample mean of specific electricity consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (MWh/(m^2·yr))

$\mu_{FCI,PJ,i,k,y}$ | Sample mean of specific consumption of fossil fuel type *k* of project buildings (premises) in buildings (premises) category *i* in year *y* (mass or volume unit/(m^2·yr))

$\mu_{WCI,PJ,i,y}$ | Sample mean of specific heat, chilled/hot water consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (GJ/(m^2·yr))

$\mu_{REFI,PJ,i,y}$ | Sample mean of specific emissions from the use of a refrigerant(s) in project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))

$ECI_{PJ,i,j,y}$ | Specific electricity consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (MWh/(m^2·yr))

$FCI_{PJ,i,j,k,y}$ Specific consumption of fossil fuel type *k* of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (mass or volume unit/(m^2·yr))

$WCI_{PJ,i,j,y}$ Specific heat, chilled/hot water consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/(m^2·yr))

$REFI_{PJ,i,j,y}$ Specific emissions from the use of a refrigerant(s) in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))

$n_{PJ,i,y}$ Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

$$\sigma_{ECI,PJ,i,y} = \sqrt{\frac{\sum_j \left(ECI_{PJ,i,j,y} - \mu_{ECI,PJ,i,y}\right)^2}{n_{PJ,i,y} - 1}} \quad \text{(A6.46)}$$

and

$$\sigma_{FCI,PJ,i,k,y} = \sqrt{\frac{\sum_j \left(FCI_{PJ,i,j,k,y} - \mu_{FCI,PJ,i,k,y}\right)^2}{n_{PJ,i,y} - 1}} \quad \text{(A6.47)}$$

and

$$\sigma_{WCI,PJ,i,y} = \sqrt{\frac{\sum_j \left(WCI_{PJ,i,j,y} - \mu_{WCI,PJ,i,y}\right)^2}{n_{PJ,i,y} - 1}} \quad \text{(A6.48)}$$

and

$$\sigma_{REFI,PJ,i,y} = \sqrt{\frac{\sum_j \left(REFI_{PJ,i,j,y} - \mu_{REFI,PJ,i,y}\right)^2}{n_{PJ,i,y} - 1}} \quad \text{(A6.49)}$$

Where:

$\sigma_{ECI,PJ,i,y}$ Standard deviation of specific electricity consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (MWh/(m^2·yr))

$\sigma_{FCI,PJ,i,k,y}$ Standard deviation of specific consumption of fossil fuel type *k* of project buildings (premises) in buildings (premises) category *i* in year *y* (mass or volume unit/(m^2·yr))

$\sigma_{WCI,PJ,i,y}$ Standard deviation of specific heat, chilled/hot water consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (GJ/(m^2·yr))

$\sigma_{REFI,PJ,i,y}$ Standard deviation of specific emissions from the use of a refrigerant(s) in project buildings (premises) in buildings (premises) category *i* in year *y* (t CO_2e/(m^2·yr))

$ECI_{PJ,i,j,y}$ Specific electricity consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (MWh/(m^2·yr))

$FCI_{PJ,i,j,k,y}$ Specific consumption of fossil fuel type *k* of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (mass or volume unit/(m^2·yr))

$WCI_{PJ,i,j,y}$ Specific heat, chilled/hot water consumption of project buildings (premises) *j* in buildings (premises) category *i* in year *y* (GJ/(m^2·yr))

$REFI_{PJ,i,j,y}$	Specific emissions from the use of a refrigerant(s) in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (t $CO_2e/(m^2 \cdot yr)$)
$\mu_{ECI,PJ,i,y}$	Sample mean of specific electricity consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (MWh/($m^2 \cdot yr$))
$\mu_{FCI,PJ,i,k,y}$	Sample mean of specific consumption of fossil fuel type *k* of project buildings (premises) in buildings (premises) category *i* in year *y* (mass or volume unit/($m^2 \cdot yr$))
$\mu_{WCI,PJ,i,y}$	Sample mean of specific heat, chilled/hot water consumption of project buildings (premises) in buildings (premises) category *i* in year *y* (GJ/($m^2 \cdot yr$))
$\mu_{REFI,PJ,i,y}$	Sample mean of specific emissions from the use of a refrigerant(s) in project buildings (premises) in buildings (premises) category *i* in year *y* (t $CO_2e/(m^2 \cdot yr)$)
$n_{PJ,i,y}$	Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

A6.5. Step 4b. Modelling project emissions

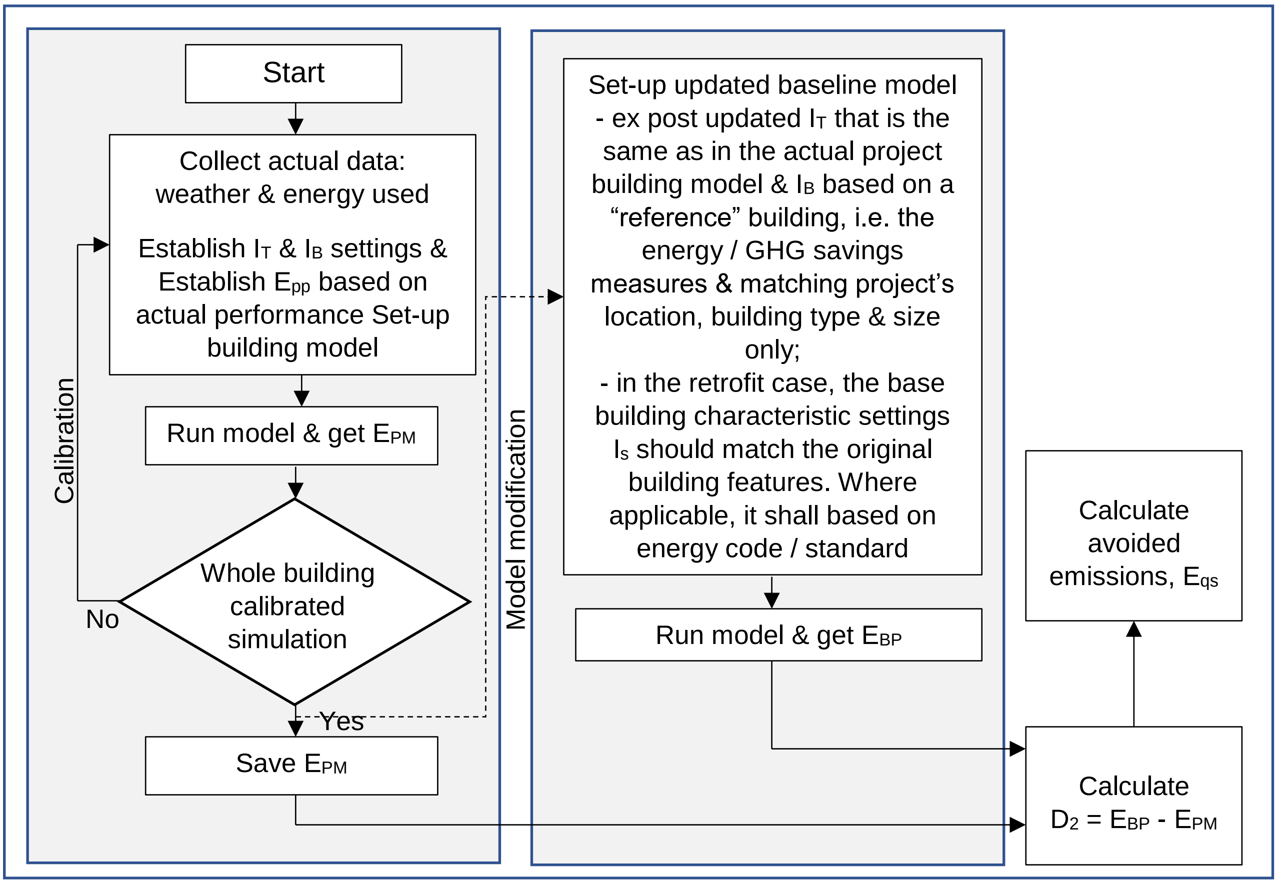
A calibrated building model of the subject buildings (premises) in the buildings (premises) category i is developed to:

1) Match (via calibration) the actual energy consumption of the project building;

2) Estimate baseline building energy consumption;

3) Determine the electrical and thermal energy savings between the project and baseline buildings, which are then multiplied by appropriate emissions factors.

Figure A6.1. Flowchart of whole building simulation



The calibrated building model is established after the end of the first year of project building operation and when 12 months of energy use data under expected ("full"[83]) operations are available for the project building.

The model is established and calibrated using the:

1) as-built project building characteristics;

2) weather, building operating characteristics, building control strategies and settings and building occupancy experienced during the same 12 month period for which energy use data under expected (full) operations are available;

3) actual annual energy used in the building during the first full year of project building operation.

The project building model is calibrated using actual energy data and the modelling process is conducted as described below:

Step 1. The following data are collected for the project building[84]:

1) physical base properties(B-settings) of the building;

2) specifications of the space conditioning system, including its performance[85]. Data collected may include such characteristics as quantities, capacities and operating characteristics of primary equipment (e.g. chillers and boilers), secondary equipment (e.g. air handling units, terminal boxes), fan sizes and types, motor sizes and efficiencies, system zoning, characteristics of duct systems and other major components;

3) control systems;

4) information about the tenancy-related characteristics (T-settings).

Step 2. Model calibration[86]:

1) a simulation input file for the project building is developed based on input data from Step 1;

2) the computer simulation results for the project building are compared to the actual energy consumption by fuel type during the same 12 month period for which energy use data under expected (full) operations are available, and whole building model is calibrated.

Step 3. Computer simulation:

1) after the project model calibration has been completed in Step 2, the calibrated model is representative of the project buildings (premises) in building category i;

2) the calibrated model is modified to represent the baseline buildings (premises) in buildings (premises) category as described above;

3) calibrated models of the project buildings (premises) and the baseline buildings (premises) are completed for each crediting period year using weather, building operating

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[83] Expected or full operations means operated on annual average at least 30 hours/week for commercial and institutional buildings and used for year-round residence for residential buildings

[84] The specific data to collect vary widely depending upon the desired tolerances of the calibration and the individual building characteristics, therefore the determination of which data to collect is left to the modeler

[85] For projects supplied by district heating or cooling, the overall thermal efficiency of the district system is included in the model. Although emission reductions from improvements to the district system are outside the scope of this methodology, its efficiency is necessary to derive the net emission reductions from measures applied to the buildings

[86] Calibration is the process of adjusting the input data or parameters in a model (as opposed to changing the form of the model) to match its output with the measured data from the real-world system. During this process, assumptions about the building's internal loads and operational characteristics are adjusted to produce a closer match between the simulated and actual energy usage

characteristics, building control strategies and settings, and building occupancy settings, referred to as tenancy settings, for each year of the crediting period.

Step 4. Documentation. The following information is reported as part of the annual emission savings documentation:

1) report the whole building simulation software used;

2) Steps 1 and 3 input files to define the project and baseline building models, ex ante and ex post, including: 1. building physical properties; 2. characteristics of the space conditioning system; 3. initial load and operating assumptions; 4. typical year weather file; 5. occupancy schedules; 6. HVAC, lighting, heating control settings; 7. Lighting, heating schedules;

3) Step 2 information documenting the calibration process, including: 1. initial simulation results for baseline building; 2. accuracy with which the simulation results match the calibration energy data. Model development and calibration documentation (including input and weather files) shall be provided to allow for accurate recreation of the model;

4) Physical base properties of the baseline and project buildings (premises), including, but not limited to: 1. building envelope (e.g. building geometry, location of building surfaces such as windows, building shades, relative position of the building thermal zones); 2. thermal properties (layer-by-layer description of the building materials with their conductivity, specific heat, and density);

5) Specification of the space conditioning system of the project and baseline buildings (premises), cooling and heating systems;

6) Specification of the control systems and control settings of the project and baseline buildings (premises);

7) Information about actual baseline and project buildings' tenancy-related settings: 1. internal loads (occupancy or average number of people per time period; lighting and equipment power density; internal load schedules); 2. building operations (control temperatures, window opening and related schedules, reflecting occupant behaviour); 3. building operation associated with the use of a district heating system (heating and hot water supply, if any);

8) Weather files for the project location with hourly data of temperature, humidity, wind direction and speed, total and diffuse solar radiation;

9) Name and qualifications of the person(s) involved in the computer simulation analyses and calibration.

A6.6. Step 5. Update of the project emission calculation

In order to reflect the changes in the energy consumption patterns of the project buildings (premises) over time, the relevant data ($EC_{PJ,i,j,y}$, $FC_{PJ,i,j,k,y}$ and $WC_{PJ,i,j,y}$) shall be collected every year from the same project buildings (premises). If a project buildings (premises) in a sample group is destroyed or its function is changed, it can be replaced by another buildings (premises) with the same function that is randomly sampled.

The calculation of the project emissions from the use of a refrigerant(s) ($PE_{ref,i,j,y}$) shall be updated annually. Alternatively, it can be updated for the first three years of the corresponding crediting period, and for any subsequent year in the crediting period, the maximum annual value of the three-year monitoring period can be used.

All the other project-related data need to be updated every third year (e.g. year 4, 7, 10). The GFA data in the project ($GFA_{PJ,i,j,y}$, $GFA_{PJ\text{-}Bldg,i,j,y}$ and $GFA_{PJ,i,y}$) may be updated more frequently in order to reflect the change in the scale of the project activity over time.

Based on the above data, the project emissions shall be updated annually after the project implementation.

All the steps should be documented transparently, including a list of the project buildings (premises) identified, with information to clearly identify the buildings (premises), as well as the relevant data used for the calculation of the project emissions.

A6.7. Emission reductions

A6.7.1. Option 1. Emissions reductions calculations without considering suppressed demand scenario

If suppressed demand for energy services is deemed not to exist prior to project implementation, emissions reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \tag{A6.50}$$

Where:

ER_y	Emission reductions in year *y* (t CO_2e/yr)
BE_y	Baseline emissions in year *y* (t CO_2e/yr)
PE_y	Project emissions in year *y* (t CO_2e/yr)
LE_y	Leakage emissions in year *y* (t CO_2e/yr)

When a whole building computerized simulation tool is used, emission reductions are determined as the differences in energy use and emissions between the baseline and project scenarios generated by calibrated models of the baseline buildings and project buildings using the weather and building occupancy experienced during each year of the crediting period and subtracting leakage emissions.

If the building computerized simulation tool allows estimating energy savings due to energy efficiency measures only, emission reductions from fuel switching (including renewables) shall be calculated using model outputs (i.e. estimated energy savings) that are multiplied with the respective emission factors.

A6.7.2. Option 2. Emissions reductions calculations under suppressed demand scenario

If a suppressed demand scenario is determined to exist, two options to address it in emissions reductions calculations are available.

Option 2a

This option is applicable if emissions reductions are estimated based on the top 20 % benchmark of best performing buildings. Under this option, a suppressed demand factor of 1,20 can be used to make a suppressed demand correction in one of the following ways:

1) in case measures implemented under the project activity are targeted at electricity consumption only, the electricity consumption of baseline buildings shall be multiplied by the suppressed demand factor to determine their baseline electricity consumption corrected for suppressed demand;

2) in case measures implemented under the project activity are targeted at space heating[87] and/or cooking only, the respective energy consumption (for heating, cooking or both, depending on which end-use the measures are targeted at) of baseline buildings shall be multiplied by the suppressed demand factor to determine their baseline energy consumption for heating and/or cooking corrected for suppressed demand;

3) in case measures implemented under the project activity are targeted at all types of energy demand, i.e. electricity, space heating and cooking, the respective energy consumption of each type of energy demand of baseline buildings shall be multiplied by the suppressed demand factor to determine their baseline energy consumption for electricity, heating and cooking corrected for suppressed demand.

Option 2b

This option is applicable if emissions reductions are estimated using a whole building computer simulation model. Depending on whether emissions reductions are estimated for the project activity dealing with new construction or retrofitting existing buildings, the following options are available:

1) For new construction, the calibrated whole building model needs to be run two times to generate baseline energy consumption in each year of the crediting period using the following inputs that are common for two runs:

a) baseline building characteristics (B-settings);

b) T-settings of the project activity buildings;

c) actual weather conditions experienced by project buildings;

d) the generated baseline energy consumption shall be used for emissions reductions calculations;

e) Run 1:

1. temperature settings:

- if relevant building code specifies indoors temperatures, these should be used as inputs;

- temperature settings be used as inputs as provided in the sanitary rules and regulations adopted by the Federal Service for Supervision of Consumer Rights Protection and Human Welfare and applicable to different categories of buildings and facilities. The source of data shall be specified in the PDD;

f) Run 2:

1. temperature settings:

- the same as in the project model observed in each relevant year of the crediting period;

2) the baseline energy consumption that shall be used for calculations of emission reductions shall be the minimum energy consumption generated by the simulation model as a result of Run 1 and Run 2;

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[87] Measures targeted at space heating may include building envelop improvements (such as improved building insulation, replacement of windows and doors) as well as improvements to space conditioning equipment (such as the refurbishment or deployment of boilers and HVAC equipment)

3) for retrofitting existing buildings, the calibrated whole building model needs to be run two times to generate baseline energy consumption in each year of the crediting period using the following inputs that are common for two runs:

a) baseline building characteristics (B-settings);

b) the average energy consumption experienced by the baseline building(s) during the last three full years prior to its retrofit;

c) T-settings of the project activity buildings;

d) actual weather conditions experienced by project buildings;

e) the generated baseline energy consumption shall be used for emissions reductions calculations;

f) Run 1:

1. temperature settings:

- if relevant building code specifies indoors temperatures, these should be used as inputs;

- temperature settings be used as inputs as provided in the sanitary rules and regulations adopted by the Federal Service for Supervision of Consumer Rights Protection and Human Welfare and applicable to different categories of buildings and facilities. The source of data shall be specified in the PDD;

g) Run 2:

1. temperature settings:

- the same as in the project model observed in each relevant year of the crediting period;

4) the baseline energy consumption used for calculations of emission reductions shall be the minimum energy consumption generated by the simulation model as a result of Run 1 and Run 2.

Appendix 7. Risk management

Table A7.1. Risk management

Stage of climate project implementation	Description of risk	Probability of occurrence	Impact on the project	Impact period	Risk minimization methods	Implementation period
		1. low *2. medium* *3. high*	*1. low* *2. medium* *3. high*	*1. preparation period* *2. 1-2 years after the implementation* *3. the entire period of the climate project*	*Detailed description of mitigation measures for each risk*	*Description of the time frame for the implementation of these activities*
		Scale from 1 to 5 or others	*Scale from 1 to 5 or others*			

Appendix 8. Leakage emissions

This appendix describes methods for calculating parameters related to leakage monitoring emissions as a result of project activities.

In Russian regulatory documents, other units of measurement may be used in comparison to the calculation formulas proposed by the methodology. In such cases, the project developer needs to perform the recalculation.

Determination of fossil fuel consumption in project buildings (premises)

If all the buildings (premises) in the project boundary are monitored as project buildings (premises), the total fossil fuel consumption ($FF_{PJ,k,y}$) shall be calculated as follows:

$$FF_{PJ,k,y} = \sum_{i}\sum_{j} FF_{PJ,i,j,y} \tag{A8.1}$$

Where:

$FF_{PJ,k,y}$	Consumption of fossil fuel *k* in all project buildings (premises) in year *y* (m^3/yr)
$FF_{PJ,i,j,y}$	Consumption of fossil fuel *k* in project buildings (premises) *j* in buildings (premises) category *i*in year *y* (m^3/yr)

If a sample of buildings (premises) in the project boundary is monitored as project buildings (premises), calculate $FF_{PJ,k,y}$ as follows:

$$FF_{PJ,k,y} = \sum_{i} FF_{PJ,k,i,y} \times N_{PJ,i,y} \tag{A8.2}$$

Where:

$FF_{PJ,k,y}$	Consumption of fossil fuel *k* in all project buildings (premises) in year *y* (m^3/yr)
$FF_{PJ,k,i,y}$	Mean consumption of fossil fuel *k* in project buildings (premises) in buildings (premises) category *i* in year *y* (m^3/yr)
$N_{PJ,i,y}$	Total number of project buildings (premises) in the population for buildings (premises) category *i* in year *y*

$$FF_{PJ,k,i,y} = \mu_{FF,PJ,k,y} + t_{0.05} \times \frac{\sigma_{FF,PJ,k,i,y}}{\sqrt{n_{PJ,i,y}}} \tag{A8.3}$$

Where:

$FF_{PJ,k,i,y}$	Mean consumption of fossil fuel *k* in project buildings (premises) in buildings (premises) category *i* in year *y* (m^3/yr)
$\mu_{FF,PJ,k,y}$	Sample mean consumption of fossil fuel *k* in project buildings (premises) in buildings (premises) category *i* in year *y* (m^3/yr)
$t_{0.05}$	t-value for a 90% statistical significance level (1,645)
$\sigma_{FF,PJ,k,i,y}$	Standard deviation of consumption of fossil fuel *k* in project buildings (premises) in buildings (premises) category *i* in year *y* (m^3/yr)
$n_{PJ,i,y}$	Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

$$\mu_{FF,PJ,k,i,y} = \frac{\sum_j FF_{PJ,k,i,j,y}}{n_{PJ,i,y}} \quad \text{(A8.4)}$$

Where:

$\mu_{FF,PJ,k,i,y}$	Sample mean of consumption of fossil fuel *k* in project buildings (premises) in buildings (premises) category *i* in year *y* (m^3/yr)
$FF_{PJ,k,i,j,y}$	Consumption of fossil fuel *k* in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (m^3/yr)
$n_{PJ,i,y}$	Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

$$\sigma_{FF,PJ,k,i,y} = \sqrt{\frac{\sum_j \left(FF_{PJ,k,i,j,y} - \mu_{FF,PJ,k,i,y}\right)^2}{n_{PJ,i,y} - 1}} \quad \text{(A8.5)}$$

Where:

$\sigma_{FF,PJ,k,i,y}$	Standard deviation of consumption of fossil fuel *k* in project buildings (premises) in buildings (premises) category *i* in year *y* (m^3/yr)
$FF_{PJ,k,i,j,y}$	Consumption of fossil fuel *k* in project buildings (premises) *j* in buildings (premises) category *i* in year *y* (m^3/yr)
$\mu_{FF,PJ,k,i,y}$	Sample mean of consumption of fossil fuel *k* in project buildings (premises) in buildings (premises) category *i* in year *y* (m^3/yr)
$n_{PJ,i,y}$	Total number of project buildings (premises) included in the sample for buildings (premises) category *i* in year *y*

Determination of fossil fuel consumption in baseline buildings (premises)

Consumption of fossil fuel type k in all baseline buildings (premises) in year y ($FF_{BL,k,y}$) is calculated as follows:

$$FF_{BL,k,y} = \sum_i FF_{Top20\%,i,k,y} \times N_{PJ,i,y} \quad \text{(A8.6)}$$

Where:

$FF_{BL,k,y}$	Consumption of fossil fuel type *k* in all baseline buildings (premises) in year *y* (volume or mass unit/yr)
$FF_{Top20\%,i,k,y}$	Mean consumption of fossil fuel type *k* in top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y* (volume or mass unit/yr)
$N_{PJ,i,y}$	Total number of project buildings (premises) in the population for buildings (premises) category *i* in year *y*

$$FF_{Top20\%,i,k,y} = \frac{\sum_j FF_{Top20\%,i,j,k,y}}{J_{i,y}} \quad \text{(A8.7)}$$

Where:

$FF_{Top20\%,i,k,y}$ — Mean consumption of fossil fuel type *k* in top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y* (volume or mass unit/yr)

$FF_{Top20\%,i,j,k,y}$ — Consumption of fossil fuel type *k* in top 20 % performer buildings (premises) *j* in buildings (premises) category *i* in year *y* (volume or mass unit/yr)

$J_{i,y}$ — Total number of top 20 % performer buildings (premises) in buildings (premises) category *i* in year *y*. It is calculated as the product of the number of baseline buildings (premises) monitored in building category *i* and 20 %, rounded down to the next integer if it is decimal

If sampling of the baseline buildings (premises) is involved in the calculation of $FF_{Top20\%,i,k,y}$, the calculated $FF_{Top20\%,i,k,y}$ shall be conservatively adjusted for the sampling error. Namely, the adjustment requires $FF_{Top20\%,i,k,y}$ to be the lower-bound value of the confidence interval established around the average consumption of fossil fuel type k of the top 20 % performer buildings (premises) at a 90 % significance level. This sample error adjustment is performed by a bootstrap method.

First, create resamples of $FF_{BL,i,j,k,y}$ by repeatedly sampling at random and with replacement[88] from the original sample of $FF_{BL,i,j,k,y}$. Each resample is the same size as the original sample and the minimum size of the resamples is 1000. Second, create a bootstrap distribution calculating $FF_{Top20\%,i,k,y}$ for each resample according to equation (A8.7). Lastly, the sample-error-adjusted $FF_{Top20\%,i,k,y}$ is the value of $FF_{Top20\%,i,k,y}$ at the 5 % percentile of the bootstrap distribution.

Appendix 9. Recommended approach for calculation of grid emissions factor (emission factor for an electricity system)

1. Currently, there are no legislatively approved grid emission factors for greenhouse gases (GHG) in the Russian Federation.

2. If the initial data required to calculate the grid emission factor for the baseline and project scenarios is available, the climate project developer has the right to calculate it independently. In this case, it is recommended to use the Guidelines for the quantitative calculation of the volume of indirect energy emissions of greenhouse gases (Order of the Ministry of Natural Resources № 330 (29.06.2017)[89]) and the principles for calculating indirect energy emissions defined in GOST R ISO 14064-1-2021[90].

To determine the grid emission factor, a regional method for calculation of indirect energy emissions is used, which reflects the average intensity of greenhouse gas emissions at facilities generating electrical and thermal energy consumed by the organization (Order of the Ministry of Natural Resources № 330).

[88] Sampling with replacement means that after randomly drawing an observation from the original sample, it is put back before drawing the next observation

[89] Order of the Ministry of Natural Resources and Ecology of the Russian Federation (29.06.2017 № 330) "On approval of guidelines for quantifying the volume of indirect energy emissions of greenhouse gases"

[90] GOST R ISO 14064-1-2021. National Standard of the Russian Federation. Greenhouse gases. Part 1. Requirements and Guidance for Quantification and Reporting of Greenhouse Gas Emissions and Absorption at the Organization Level (approved and enacted by Rosstandart Order 30.09.2021 №1029-st)

According to GOST R ISO 14064-1-2021 (Appendix E), emissions from imported electricity must be calculated by the project developer using a location-based approach[91] by applying an emission factor that best characterizes the relevant electric power system, i.e. leased transmission line, local, regional or national grid average emission factor. The grid-averaged emission factors should refer to the emissions of the reporting year, if available, or otherwise the latest available year. Grid-averaged emission factors for imported electricity should be based on the average consumption pattern from the electric power system from which the electricity is consumed.

Grid emission factors may also include other indirect emissions associated with electricity generation, such as transmission and distribution losses.

The requirements and guidance described in ISO 14064-1-2021 for electricity also apply to consumed and transferred heat, steam, cooling air and compressed air.

In case of energy from cogeneration facilities, it is necessary to use approaches to separate various forms of energy[92].

Association "NP Market Council (Sovet Rynka)" and JSC "ATS" have developed a concept for calculating and publishing greenhouse gas emission factors for the energy system of the Russian Federation[93]. Based on the results of the peer review, independent international auditors issued an assurance certificate, and this concept received a validation report[94]. It is assumed that the implementation of this concept will lead to the more accurate calculation and publication of grid emission factors. The approaches outlined in the concept can also be used by the project developer to calculate the emission factor of the electric power system.

3. If it is impossible to calculate the grid emission factor on its own, the project developer can use grid emission factors from the following sources:

Source 1. JSC "Administrator of the Trading System" in test mode in 2021 launched an Internet resource that publishes the grid CO2 emission factor for the first synchronous zone of the Russian Federation for various time periods (hour, day, month, year) [95].

Source 2. Emission factors of the International Energy Agency (IEA). The data is updated annually for the entire energy system of the regions (including the Russian Federation) and reflects the average carbon intensity of electricity and heat generation[96].

Source 3. Climate Transparency Global Partnership develops G20[97] climate indicators. The agency publishes annually reports from the G20 countries, including the average energy emission factor.

4. Methods and approaches applied to the calculation of the grid emission factor should be documented and specified in the PDD. It is necessary to justify the chosen calculation

[91] The location-based approach is a method for quantifying indirect energy emissions based on average emission factors from energy production for a given geographic location, including local, regional or national boundaries
[92] For example, calculation of specific fuel consumption in accordance with the "Guidelines for the distribution of specific fuel consumption in the production of electrical and thermal energy within combined generation of electrical and thermal energy, used for the purpose of tariff regulation in the heat supply", legislatively approved by the Order of the Ministry of Energy of the Russian Federation (12.09.2016 №952)
[93] The concept of calculation and publication of greenhouse gas emission factors for the energy system of the Russian Federation URL: https://www.np-sr.ru/sites/default/files/koncepciya_kev.pdf
[94] As part of the validation procedure, a detailed verification of the Concept was carried out for its compliance with the requirements of the international standards in the field of accounting and reporting on greenhouse gas emissions (TÜV AUSTRIA). Based on the results of the audit, the Concept was recognized by international experts as complying with high international standards and best international practices for calculating energy system emission factors. URL: https://www.np-sr.ru/sites/default/files/zaklyuchenie_o_validacii_koncepcii.pdf
[95] URL: https://www.atsenergo.ru/results/co2
[96] URL: https://www.iea.org/data-and-statistics/data-product/emissions-factors-2021
[97] URL: https://www.climate-transparency.org/g20-climate-performance/g20report2022#1531904804037-423d5c88-a7a7

methodology, disclose information about the source of the initial data used, transparently and accurately document your own procedure for calculating the grid emission factor, or describe the properties of the selected and applied grid emission factor.

Appendix 10. Recommended approach for calculation of indirect energy emissions factor for captive use and mini-grid

1. Calculation of the indirect energy emissions factor for captive use and mini-grid electricity consuming is carried out by the market approach (Order of the Ministry of Natural Resources of Russia №330 29.06.2017[98]).

2. The market approach is used when the electricity consumed is received under bilateral contracts for the sale of electricity, signed in accordance with the rules of the wholesale electricity and capacity market and the operation of retail electricity markets[99]. Market factors of indirect energy emissions are indicated in sales contracts, in retail electricity markets contracts; or provided in certificates confirming the volume of electricity production at generating facilities produced from renewable energy sources, information about which is entered in the register[100]; or calculated based on the volumes of electricity received from specific external generating facilities in accordance with the terms of sales contracts, retail market contracts or certificates for the reporting period. Methodological guidelines for the calculation are set out in the Order of the Ministry of Natural Resources of Russia №330 29.06.2017.

3. If the supplier of electricity under sales contracts, retail market contracts or certificates has several generating facilities[101], the market factor is determined only for the generating facility (or generating facilities) from which (or from which) electricity is received by the consumer.

4. If additional electrical energy is consumed under project activity, that was not declared by sales contracts, retail market contracts or certificates (undeclared balance of electricity, i.e. the amount of electricity consumed in excess of the established contract (and) and/or certificate(s)), then the volume of the undeclared balance of electrical energy is determined based on the information of electricity received from external generating facilities located in the regional energy system. Thus, indirect energy emissions from the consumption of electricity received under contracts and/or certificates are calculated based on the market approach, and indirect emissions from the consumption of undeclared balance of electricity - using location-based approach (see Appendix 9).

5. In the Russian Federation there are generating facilities that do not connected with the Unified Energy System of Russia - Technologically isolated territorial electric power system (TITEPS[102]). In such cases, calculation of indirect energy emissions should be based on the

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[98] Order of the Ministry of Natural Resources and Ecology of the Russian Federation (29.06.2017 № 330) "On approval of guidelines for quantifying the volume of indirect energy emissions of greenhouse gases"
[99] Federal Law "On the Electric Power Industry" with amendments and additions (26.03.2003 №35-FZ)
100 Decree of the Government of the Russian Federation "On some issues related to the certification of volumes of electrical energy produced at generating facilities operating on the use of renewable energy sources" with amendments and additions (№117 17.02.2014)
[101] For example, hydropower stations or thermal power stations
[102] Technologically isolated territorial electric power system (TITEPS) - an electric power system located on the territory determined by the Government of the Russian Federation, which has no technological connection with the Unified Energy System of Russia (GOST R 57114-2016 Unified energy system and isolated operating energy systems. Electric power systems. Operational and dispatching management in the electric power industry and operational-technological management. Terms and definitions.)

individual emission factors of all generating facilities included in mini-grid (the Order of the Ministry of Natural Resources of Russia №330 29.06.2017).

6. Market approach is not used to calculate indirect energy emissions from heat consumption. Thermal energy received from external generating facilities is evaluated by the location-based approach (the Order of the Ministry of Natural Resources of Russia №330 29.06.2017).

7. The project developer needs to ensure that the used approaches and data comply with the general requirements and guidance for considering imported electricity consumed for project activity set out in GOST R ISO 14064-1-2021[103] (Appendix E).

8. Used input data sources, applied methods and approaches should be documented and specified in the PDD. It is necessary to justify the chosen calculation methodology, disclose information about the source of the initial data used, transparently and accurately document procedure for calculating indirect energy emission factor based on market approach.

[103] GOST R ISO 14064-1-2021. National Standard of the Russian Federation. Greenhouse gases. Part 1. Requirements and Guidance for Quantification and Reporting of Greenhouse Gas Emissions and Absorption at the Organization Level (approved and enacted by Rosstandart Order 30.09.2021 №1029-st)